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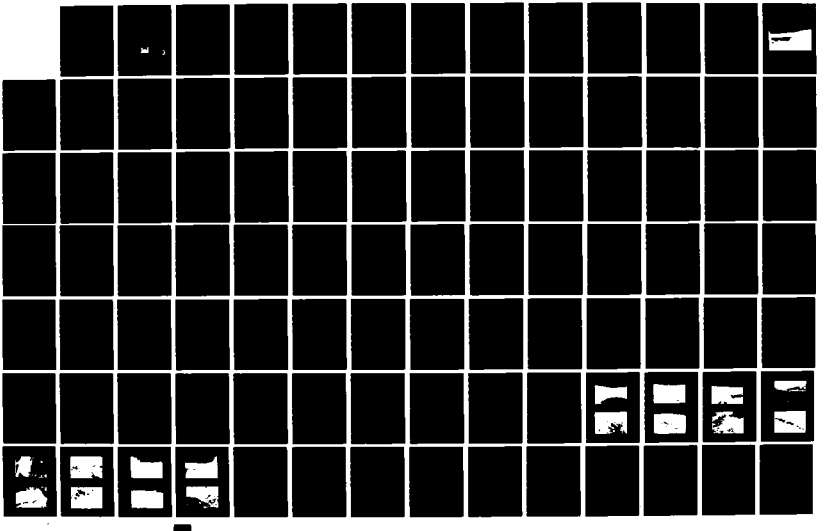

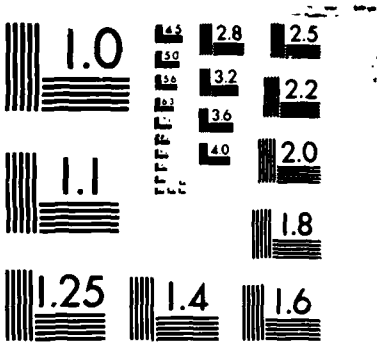

(1)

CONNECTICUT RIVER BASIN

TOPSHAM, VERMONT

CLARK SITE NO. 2 DAM

VT 00266

VTDWR 208-1

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS. 02154

AUGUST 1981

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18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Connecticut River Basin
Topsham, VT.
Tributary of Tabor Branch

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a 32 ft. high earth embankment with a drop inlet principal spillway and a vegetated earth channel emergency spillway. The dam is small in size with a significant hazard potential. The dam is in poor condition at the present time It is recommended that the owner engage the services of a qualified engineer to conduct a detailed study of the seepage at both abutments and the dowstream toe of the embankment.THere are remdial measures which must be undertaken by the owner.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:

NEDED

SEP 16 1981

Honorable Richard A. Snelling
Governor of the State of Vermont
State Capitol
Montpelier, VT 05602

Dear Governor Snelling:

Inclosed is a copy of the Clark Site No. 2 Dam (CT-00266) Phase I Inspection Report, prepared under the National Program for Inspection of Non-Federal Dams. This report is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. I approve the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is vitally important.

Copies of this report have been forwarded to the Department of Environmental Management and to the owner, Mrs. Elizabeth Clark, Woodbridge, CT. Copies will be available to the public in thirty days.

I wish to thank you and the Department of Environmental Management for your cooperation in this program.

Sincerely,

C. E. EDGAR, III
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

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NATIONAL DAM INSPECTION

PHASE I INSPECTION REPORT

Identification No.:	VT00266
VTDWR No.:	208-1
Name of Dam:	Clark Site No. 2 Dam
Town:	Topsham
County and State:	Orange, Vermont
Stream:	Tributary of Tabor Branch
Date of Inspection:	June 2, 1981

BRIEF ASSESSMENT

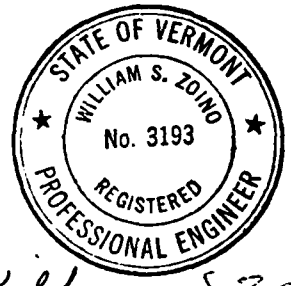
The Clark Site No. 2 Dam is located on an unnamed tributary of the Tabor Branch of the Waits River, approximately 2.7 miles upstream of East Topsham, Vermont. The dam is a 32-foot-high earth embankment with a drop inlet principal spillway and a vegetated earth channel emergency spillway. The overall length of the dam is 725 feet, including the 35-foot-wide emergency spillway. The maximum impoundment behind this dam is 78 acre-feet. The dam was constructed in 1974 to be used as a private recreation area. It is presently owned by Mrs. Elizabeth M. Clark of Woodbridge, Connecticut.

The drainage area for the dam covers 0.2 square miles of rolling terrain. The dam is SMALL in size, and its hazard potential classification is SIGNIFICANT since appreciable economic loss and possible loss of a few lives could result from the event of a dam failure. The appropriate test flood for a dam classified as small with a significant hazard potential is between the 100-year flood and one-half the Probable Maximum Flood. The 100-year flood has been adopted as the appropriate test flood. The 100-year inflow is 150 cfs for this dam. Surcharge storage in the reservoir results in an outflow of 110 cfs with the water surface at elevation 1648.8 feet (NGVD). This test flood would result in 0.8 feet of flow over the emergency spillway. The spillways at this dam are capable of passing 760% of the test flood without overtopping.

The dam is in POOR condition at the present time. It is recommended that the owner retain the services of a qualified registered professional engineer to conduct a detailed study of the seepage at both abutments and the downstream toe of the embankment.

Remedial measures to be undertaken by the owner include ensuring the operability of the pond drain, implementing annual maintenance and inspection programs, immediately developing a plan for surveillance of the project area during periods of intense rainfall, and preparing a formal plan for warning the downstream residents and the appropriate officials in the event of an emergency.

The recommended engineering study and surveillance of the project should be implemented by the owner immediately upon receipt of this Phase I Inspection Report. The remaining remedial measures should be implemented within one year of receipt of this report.



William S. Zoino
VT Registration No. 3193

Nicholas A. Campagna,Jr.
CA Registration No. 21006

This Phase I Inspection Report on Clark Site No 2 (VT00226) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

J W Finegan

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

Aramast Mahtesian

ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared in accordance with the "Recommended Guidelines for Safety Inspection of Dams", for Phase I Investigations. Copies of these Guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C., 20314. The purpose of a Phase I Investigation is to identify expenditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and anaylses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify the need for any such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection, along with data available to the inspection team. In cases whether the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam in the future. Only through continued care and inspection can unsafe conditions be detected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should be interpreted as necessary posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, "no trespassing" signs, repairs to existing fences and railings, or other items which may be needed to minimize trespassing and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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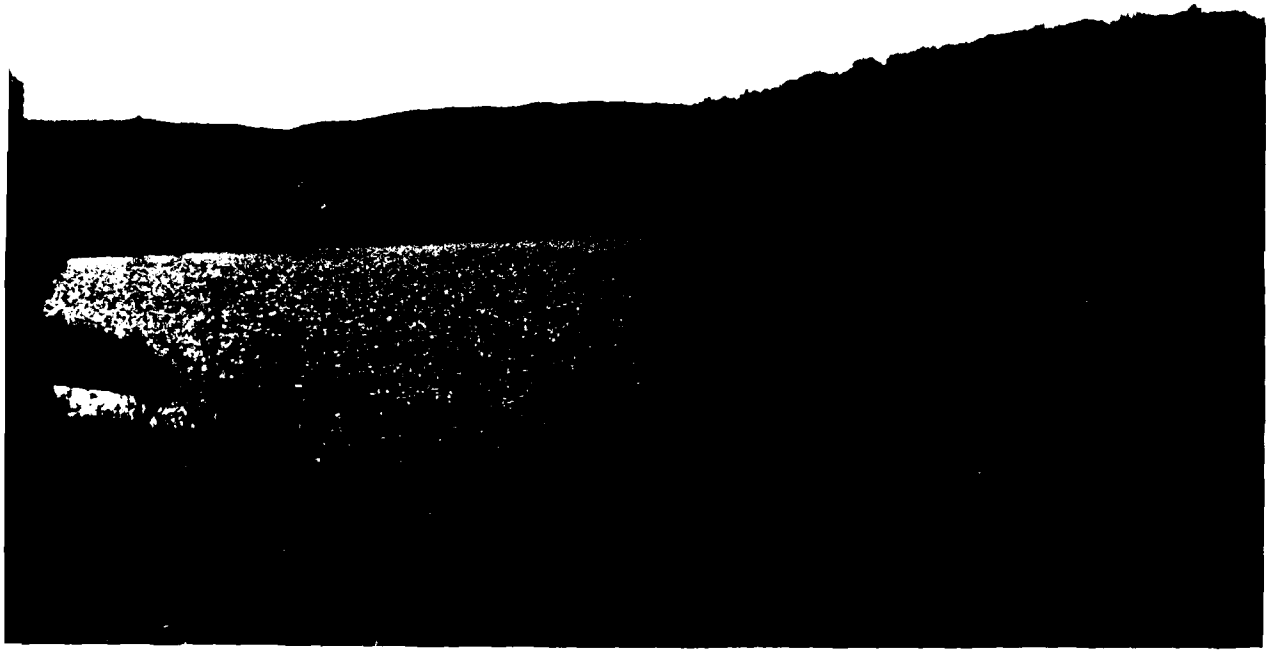
APPENDICES



Overview of Dam

(d) Reservoir Area (See Photo 15)

The shore of the reservoir area consists of gently sloping woodland. It appears to be stable and in good condition.

(e) Downstream Channel (See Photo 16)

The narrow channel slopes gently down the natural streambed. The channel appears stable and in good condition.

2 Evaluation

The dam is in poor condition. The problem areas noted during ıe visual inspection are listed as follows:

(a) Seepage from both abutments should be investigated immediately, and corrective actions implemented.

(b) Brush growth on slopes and spillway channel obscures the slope, making inspection difficult. Damage could occur due to root growth.

(c) Slough on downstream slope.

is supersaturated and is sloughing. A concrete ring cistern, 3 feet in diameter, is located near the lower end of this area. The purpose of the cistern is not clear. There is no inlet or outlet pipe to the structure. A small, 25-gpm gasoline pump was brought to the site by the inspection party. The inflow into the cistern, after pumping it down, was less than 1 gallon per minute. There is a similar cistern near the right abutment at the downstream toe. The measured inflow after pumping was approximately 1 gallon per minute. Thus, none of the seepage from the abutments is entering the cistern. The seepage through the abutments at this dam is a serious problem, causing sloughing at the left abutment and instability of the toe at both abutments.

(2) Emergency Spillway (See Photos 13 and 14)

There is heavy brush growth in the emergency spillway channel and on the adjacent diversion berm. The channel has been cut into the right abutment and appears to be in good condition with the exception of the brush growth.

(c) Appurtenant Structures

(1) Principal Spillway (See Photos 6 and 11)

The antivortex cover and trash rack are in good condition, as is the downstream end of the 18-inch-diameter outlet pipe.

(2) Pond Drain (See Photo 12)

The downstream end of the 8-inch-diameter outlet pipe is in good condition. The remainder of the system was submerged and could not be observed. No flow was emanating from the outlet. The operability of this outlet is unknown.

(3) Toe Drains (See Photo 12)

Two toe-drain outlet pipes, one on either side of the pond drain outlet, show no flow. It is unclear whether these drains are functional.

Section 3: Visual Inspection

3.1 Findings

(a) General

The Clark Site No. 2 Dam is in poor condition at the present time.

(b) Dam

(1) Embankment (See Photos 1, 2, 3, 4, 5, 7, 8, 9, and 10)

The alignment of the dam, along the crest, is generally good. Survey results indicate the crest to be 1.4 feet to 2.3 feet higher than the design settled-fill level. It appears that the full estimated settlement did not occur. There is some rutting of the crest due to vehicular traffic.

The upstream slope appears to be in good condition, although there is moderate to heavy brush growth along most of the exposed slope.

There is a slough on the downstream slope approximately 280 feet from the left abutment and approximately 25 feet down the slope. This slough is roughly 10 feet square. It is not clear whether this slough is the result of surface erosion or of seepage under high reservoir conditions.

There is seepage emanating from the downstream toe of the dam, approximately 250 feet from the left abutment. The flow from this area is approximately 1 gallon per minute, and it is clear and clean except for some minor rusting at the exit point.

The entire downstream toe is wet from the left abutment to the area of the spring discussed above. From this point, the wet area turns downstream of the toe to the outlet channel.

The left abutment shows seepage on the order of 20 to 30 gallons per minute. A triangular area, approximately 50 feet on each side, at the left abutment

conducted by the inspection party indicated the crest of the dam to be a minimum of 4.9 feet above the crest of the principal spillway. The relative elevations of the dam components used in this report are the results of the survey. The conversion to the National Geodetic Vertical Datum was accomplished by estimates from the USGS Quadrangle map.

Section 2: Engineering Data

2.1 Design Data

The design calculations and drawings prepared by the USDA Soil Conservation Service are available from the Burlington Office of the S.C.S. The results of an inspection dated October 10, 1980, are available from the Vermont Department of Water Resources.

2.2 Construction Records

No construction records are available for this dam.

2.3 Operational Records

No operational records are available for this dam.

2.4 Evaluation of Data

(a) Availability

The original design calculations and drawings are readily available, but no construction records could be obtained.

(b) Adequacy

Although some of the design information is available, there is insufficient information to permit a definitive review. Therefore, this assessment of the dam is based on a review of available data, combined with the visual inspection, past performance, and sound engineering judgment.

(c) Validity

Some discrepancies were noted between the design data and the observations of the inspection team. The emergency spillway is located at the right abutment rather than the left abutment as shown, and the elevation of the top of the dam is approximately 1.4 feet higher than the design elevation. The dam was intended to be constructed with a camber to elevation 104.3 (1653.3 NGVD) at maximum section. It appears that full estimated settlement did not occur, as the dam is generally 1.4 feet to 2.3 feet higher than the design settled-fill level. A limited level survey

(7) Impervious core: None

(8) Cutoff: Earthfill cutoff trench, 8 feet wide, variable depth

(9) Grout curtain: None

(h) Diversion and Regulating Tunnel

Not applicable

(i) Spillway

(1) Type: Principal spillway: 24-inch-diameter corrugated metal pipe drop inlet

Emergency spillway: vegetated earth channel cut in right abutment

(2) Length of weir: Principal spillway: 24-inch diameter
Emergency spillway: 35 feet

(3) Crest elevation: Principal spillway: 1647 NGVD
Emergency spillway: 1648 NGVD

(4) Gates: None

(5) Upstream channel: Reservoir

(6) Downstream channel: Narrow stream over rolling terrain

(k) Regulating Outlets

The only regulating outlet at this dam is the pond drain, which is an 8-inch-diameter metal pipe equipped with a flap valve at elevation 1626.6 feet (NGVD)

(4) Top of dam: 1000

(5) Test flood pool: 1000

(e) Storage (acre-feet)

(1) Normal pool: 62

(2) Flood control pool: Not applicable

(3) Spillway crest pool: Principal spillway: 62
Emergency spillway: 71

(4) Top of dam pool: 105

(5) Test flood pool: 78

(f) Reservoir Surface (acres)

(1) Normal pool: 7.8

(2) Flood control pool: Not applicable

(3) Spillway crest pool: Principal spillway: 7.8
Emergency spillway: 8.6

(4) Test flood: 9.2

(5) Top of dam: 12.0

(g) Dam

(1) Type: Earth embankment with 8-foot-wide cutoff trench

(2) Length: Approximately 725 feet

(3) Height: Approximately 32 feet

(4) Top width: 15 feet

(5) Side slopes: Upstream: 3 horizontal to 1 vertical
Downstream: 2 horizontal to 1 vertical

(6) Zoning: Homogeneous

(7) Total Spillway Capacity at Test Flood

The total spillway capacity at Test Flood elevation (1648.8 feet NGVD) is 110 cfs.

(8) Total Project Discharge at Top of Dam

The total project discharge at top of dam elevation (1651.9 feet NGVD) is 843 cfs.

(9) Total Project Discharge at Test Flood Elevation

The total project discharge at Test Flood elevation (1648.8 feet NGVD) is 110 cfs.

(c) Elevation (feet above NGVD)

(1) Streambed at toe of dam: Approximately 1620

(2) Bottom of cutoff: Unknown

(3) Maximum tailwater: Unknown

(4) Normal pool: Approximately 1647.0

(5) Full flood control pool: Not applicable

(6) Spillway crest: Principal spillway: 1647
Emergency spillway: 1648

(7) Design surcharge: 1649.0

(8) Top of dam: 1651.9

(9) Test flood surcharge: 1648.8

(d) Reservoir (length in feet)

(1) Normal pool: 1000

(2) Flood control pool: Not applicable

(3) Spillway crest pool: 1000

1.3 Pertinent Data

(a) Drainage Area

The drainage area for this dam covers 0.2 square miles. It is made up entirely of rolling woodland. The maximum elevation of the drainage area is approximately 1,920 feet (NGVD).

(b) Discharge at Dam Site

(1) Outlet Works

The outlet works at this dam include an 8-inch-diameter pond drain equipped with a flap gate at elevation 1626.6. The capacity of the pond drain with the reservoir at the top of dam elevation (1651.9 feet NGVD) is 8 cfs. Normal discharge is through a 24-inch-diameter drop inlet at elevation 1647.0.

(2) Maximum Known Flood

No records of flow or stage are available for this dam.

(3) Ungated Spillway Capacity at Top of Dam

The capacity of the principal spillway with the reservoir at top of dam elevation (1651.9 feet NGVD) is 52 cfs. The capacity of the emergency spillway is 791 cfs at this level.

(4) Ungated Spillway Capacity at Test Flood

The capacity of the principal spillway with the reservoir at Test Flood elevation (1648.8 feet NGVD) is 49 cfs. The capacity of the emergency spillway is 61 cfs at this level.

(5) Gated Spillway Capacity at Normal Pool

There are no gated spillways.

(6) Gated Spillway Capacity at Test Flood

There are no gated spillways.

(d) Hazard Potential Classification

The hazard potential classification for this dam is SIGNIFICANT because of the appreciable economic losses and the potential for loss of a few lives which could result from the event of a dam failure. Three houses located 14,000 feet downstream of the dam would experience no prefailure flooding. These houses would be subjected to failure flows with a velocity up to 12 feet per second and flooding up to two feet deep.

(e) Ownership

The dam is owned by Mrs. Elizabeth Clark, wife of Gordon Clark, of Newton Road, Woodbridge, Connecticut, 06525. The caretaker living on the property is Mr. Earl Eastman of Topsham, Vermont.

(f) Operator

The operation of the dam is controlled by the caretaker of the property, Mr. Earl Eastman. Mr. Eastman can be reached by telephone at 802-584-3355.

(g) Purpose of the Dam

The dam is on private property and is used as a private recreation facility.

(h) Design and Construction History

The dam was constructed in 1974. The construction was accomplished by Mr. Henry M'Greevy of Bradford, Vermont. The design is by the USDA Soil Conservation Service.

(i) Normal Operating Procedure

No formal operating procedures exist for this dam. The pond drain is normally closed.

There is an 8-inch-diameter drain extending 20 feet into the reservoir from the drop inlet. The invert of this drain is 3 feet below the crest of the drop inlet.

The discharge conduit is equipped with five antiseep collars constructed of galvanized corrugated sheets.

(3) Pond Drain

A separate pond drain is located approximately 250 feet to the left of the spillway inlet. This drain is located approximately 20 feet lower than spillway outlet and is constructed of 8-inch-diameter corrugated metal pipe. It is equipped with an "Arnold" type farm pond drain valve and four antiseep collars. Available plans indicate the invert of the intake at elevation 1626.6 and the invert of the downstream end at elevation 1617.6

(4) Emergency Spillway and Diversion Berm

The emergency spillway was cut into the right abutment. It is 35 feet wide at the control section and 2.5 feet below the crest of the dam. The channel is approximately 200 feet long.

A diversion berm has been constructed along the left side of the spillway channel to prevent flow from eroding the downstream toe of the dam. This berm has a 4-foot-wide crest and 2 horizontal to 1 vertical side slopes.

(c) Size Classification

The dam has a maximum impoundment of 105 acre-feet and a height of 32 feet. According to the Corps of Engineers' Recommended Guidelines, a small size dam is one with a maximum storage section between 50 acre-feet and 1,000 acre-feet, or a height between 25 feet and 40 feet. Therefore, this dam is classified as SMALL, based on both criteria.

1.2 Description of Dam

(a) Location

The Clark Site No. 2 Dam is located on a tributary of the Tabor Branch of the Waits River, approximately 2.7 miles upstream of East Topsham, Vermont and 3 miles upstream of the confluence with the Tabor Branch. The impoundment is shown on the USGS Groton, Vermont Quadrangle at approximate coordinates N44 9.3', W72 13.2' (see Location Map on Page vi). Page B-2 of Appendix B is a site plan for this dam.

(b) Description of Dam and Appurtenances

The Clark Site No. 2 Dam consists of an earth embankment with an 24-inch-diameter drop-inlet spillway leading to a 18-inch-diameter discharge conduit; and an earth channel emergency spillway which has been cut into the right abutment. The overall length of the dam is 725 feet, and it is 32 feet high.

(1) Embankment

According to available design information, the embankment is made up of homogeneous earth fill with a 3 horizontal to 1 vertical upstream slope and a 2 horizontal to 1 vertical downstream slope. There is an 8-foot-wide, earthfill cutoff trench below the embankment. This cutoff is of variable depth.

Available plans shown an 8-foot-wide by 4-foot-high trench drain near the downstream toe. This drain is constructed of clean, well-graded, bank run gravel, and it contains a 6-inch-diameter perforated pipe for 80 feet to either side of the pond drain outlet. The toe drain outlets are located 3 feet to either side of the pond drain outlet.

(2) Principal Spillway

The principal spillway consists of a 24-inch-diameter, corrugated metal pipe drop inlet leading to a 18-inch-diameter corrugated metal pipe discharge conduit. The drop inlet is equippped with an antivortex cover and trash guard constructed of steel plate and rod.

National Dam Inspection Program

Phase I Inspection Report

Clark Site No. 2 Dam

Section 1: Project Information

1.1 General

(a) Authority

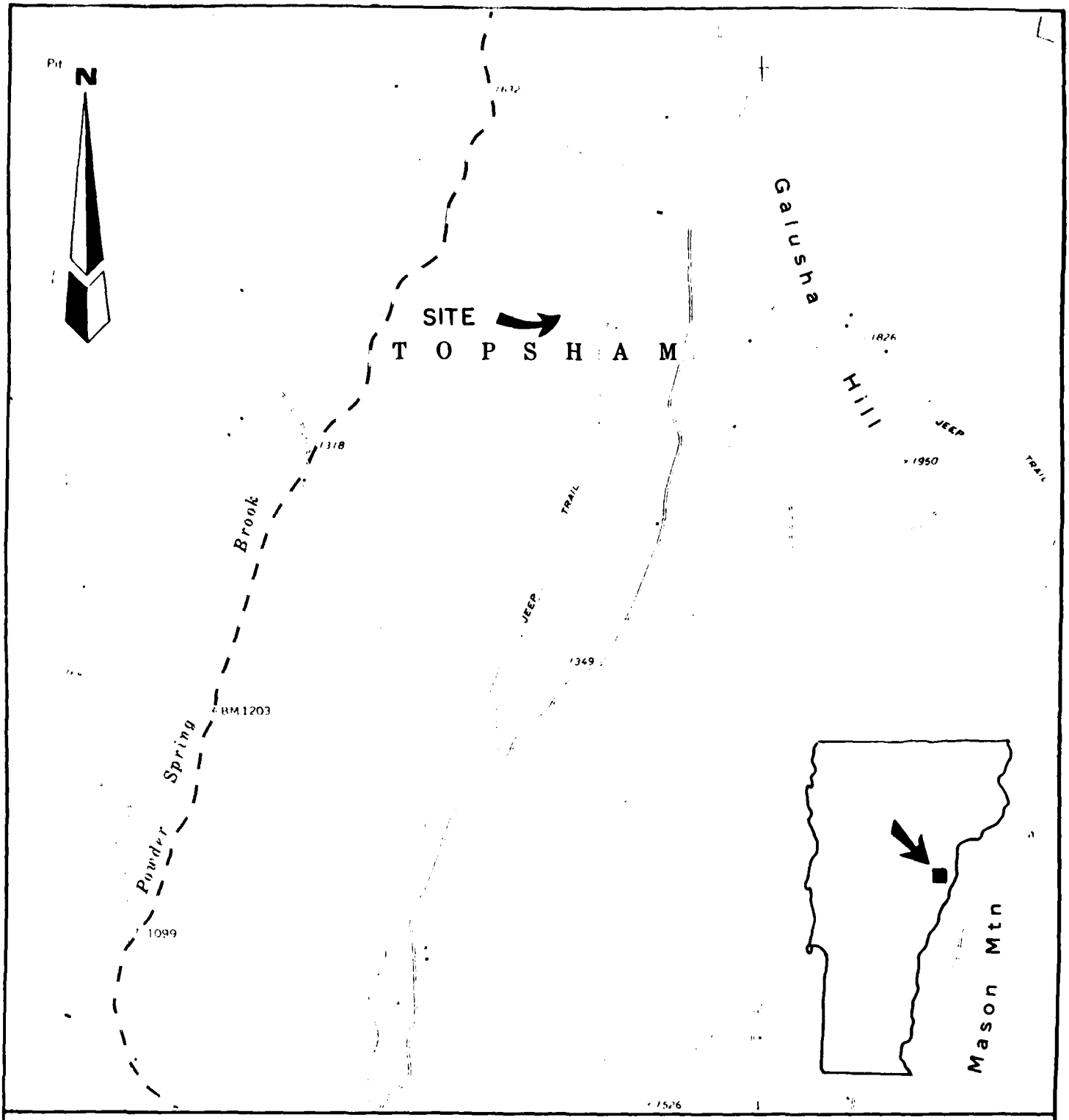
Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Goldberg-Zoino & Associates, Inc. (GZA) has been retained by the New England Division to inspect and report on selected dams in the States of New Hampshire and Vermont. Authorization and notice to proceed were issued to GZA under a letter of May 26, 1980, from Colonel William E. Hodgson, Jr., Corps of Engineers. Contract No. DACW 33-80-C-0055 has been assigned by the Corps of Engineers for this work.

(b) Purpose

(1) Perform technical inspection and evaluation of nonfederal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by nonfederal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for nonfederal dams.

(3) Update, verify, and complete the National Inventory of Dams.



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0 1000 2000 4000 (FT)

FROM: USGS GROTON - VT. QUADRANGLE MAP

GOLDBERG · ZOINO & ASSOCIATES, INC.
GEOTECHNICAL - GEOHYDROLOGICAL CONSULTANTS
NEWTON UPPER FALLS, MASSACHUSETTS

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCUS PLAN

FILE No. 2605

CLARK SITE 2 DAM TOPSHAM, VERMONT

SCALE	AS NOTED
DATE	MAY 1981

Section 4: Operational and Maintenance Procedures

4.1 Operational Procedures

(a) General

No written operational procedures exist for this dam. The dam serves as a private recreation area.

(b) Description of Warning System

There is no warning system in effect.

4.2 Maintenance Procedures

(a) General

Maintenance of the dam is performed occasionally by the caretaker who lives on the property. No formal maintenance program exists for this dam.

(b) Maintenance of Operating Facilities

No maintenance program exists for the operating facilities of this dam. The gates are not operated regularly.

4.3 Evaluation

Emphasis on routine maintenance will assist the owner in assuring the long-term safety of the dam and operating facilities. A formal, written, downstream emergency warning system should be developed for this dam.

Section 5: Evaluation of Hydraulic/Hydrologic Features

5.1 General

Clark Site No. 2 Dam impounds a recreational pond on an unnamed tributary of the Tabor Branch of the Waits River in East Topsham, Vermont. The dam is about 2.7 miles upstream from the village of East Topsham and 3 miles upstream from the confluence of the tributary and the Tabor Branch.

The dam is a 660-foot-long earth embankment with a 35-foot-wide, grass-lined emergency spillway. The overall length of the dam is 725 feet. The principal outlet is a drop inlet type and consists of a 24-inch-diameter corrugated metal riser which joins an 18-inch corrugated metal drain pipe which passes through the base of the embankment. There is a separate 8-inch-diameter corrugated metal pipe pond drain.

The unnamed outlet stream is narrow and steep. It passes through heavily wooded terrain for about 14,000 feet downstream of the dam. At this point, the stream valley widens and the overbanks are relatively flat meadows, before the stream passes beneath a secondary roadway. A 6-foot-diameter corrugated metal pipe carries the stream beneath this roadway. Three houses in the village of East Topsham, with first-floor elevations from three to five feet above the roadway surface (11 to 13 feet above the streambed), are located nearby.

About 3,000 feet downstream of the road crossing, the stream joins the Tabor Branch of the Waits River. No development exists in this reach or downstream of the confluence at elevations low enough to be endangered by failure flows from the dam.

5.2 Design Data

Data sources available for Clark Site No. 2 Dam include the 1973 SCS design calculations and drawings, the permit application and accompanying documents required by the State of Vermont Water Resources Board, and a Vermont Department of Water Resources Dam Inspection Report dated October 10, 1980.

The spillway capacities are based on the standard SCS empirical design methods for a 50-year rainfall frequency with a depth of 5 inches (see Pages B-20 and B-21).

5.3 Experience Data

No records of flow or reservoir levels are available on Clark Site No. 2 Dam or on the small tributary stream in the downstream vicinity.

5.4 Test Flood Analysis

The hydrologic conditions of interest in this Phase I investigation are those required to assess the dam's overtopping potential and its ability to allow an appropriately large flood to pass safely. This requires using the discharge and storage characteristics of the structure to evaluate the impact of an appropriately sized Test Flood.

Guidelines for establishing a recommended Test Flood based on the size and hazard classifications of a dam are specified in the "Recommended Guidelines" of the Corps of Engineers. The impoundment of 110 acre-feet and height of 30 feet classify this dam as a SMALL structure. The hazard potential for Clark Site No. 2 Dam is considered to fall within the SIGNIFICANT category.

As shown in Table 3 of the Corps of Engineers' "Recommended Guidelines," the appropriate Test Flood for a dam classified as small in size with a significant hazard potential would be between the 100-year flood and one-half times the Probable Maximum Flood (PMF). Since the dam is on the low side of the small classification, the Test Flood inflow to the Clark Site No. 2 Dam is the 100-year flood.

The magnitude of the 100-year flood has been estimated to be equal to one quarter of the PMF, as determined from the chart of "Maximum Probable Flood Peak Flow Rates" obtained from the Corps of Engineers, New England District. By this method, the 100-year peak inflow is estimated to be 150 cfs at the Clark Site No. 2 Dam. The procedure suggested by the Corps of Enginers, New England Division, for "Estimating the Effect of Surcharge Storage on Maximum Probable Discharges" produces a Test Flood outflow at the dam of 110 cfs.

The stage-storage curve is developed by summing the flow through the primary spillway and over the emergency spillway and dam crest at incremental elevations. The support calculations are included in Appendix D.

The dam can pass the selected Test Flood without overtopping. At a discharge of 110 cfs, flow would be 0.8 foot deep in the emergency spillway, 3.1 feet below the dam crest. The combined capacity of 840 cfs for the principal and emergency spillways with a water level at the dam crest is 760% of the peak Test Flood outflow of 110 cfs.

5.5 Dam Failure Analysis

The outflow that would result from a dam failure is estimated using the procedures suggested in the Corps of Engineers, New England Division's April 1978 "Rule of Thumb Guidelines for Estimating Downstream Dam Failure Hydrographs." Failure is assumed to occur when the dam crest is overtopped at an elevation of 1651.9 feet. This is 4.9 feet above the principal spillway crest and some 30 feet above the streambed. Just prior to failure, the normal combined outflow through the principal and emergency spillways would be 840 cfs. Assuming a 152-foot gap is opened in the dam, the peak failure outflow at the dam is estimated to be 42,600 cfs.

Following the "Rules of Thumb Guidelines," the breach flow was routed to the impacted area in East Topsham. The attenuated peak failure flow at the impact area is estimated to be 5,000 cfs. This flow would far exceed the capacity of the culvert beneath the roadway in the impact area and cause substantial flood damage to the three houses located adjacent to the stream and roadway. The prefailure flow would not reach the houses but the failure wave would cause flooding up to two feet deep with a velocity up to 12 feet per second.

Downstream of this area, the flood wave would rapidly attenuate in the storage available in the broad, flat overbanks. No further development occurs at elevations low enough to be affected by failure flooding.

Ordinarily, any dam-break flood which produces a water depth of 2 feet in at least two homes which have no prefailure flooding would cause the dam to be classified as a high hazard dam. However, since prefailure flood conditions from spillway discharges produce a flood within 1 to 3 feet of the house sill elevations and since the extremely large intervening drainage area between the dam and the houses would produce an even greater prefailure flood, a significant classification is considered reasonable.

Section 6: Structural Stability

6.1 Visual Observations

There has been no significant displacement nor distress which would warrant the preparation of structural stability calculations, based on assumed sectional properties and engineering factors.

Seepage conditions existing at abutments do not warrant structural analysis at present. Continued seepage could lead to stability problems and a thorough investigation of these conditions by a registered professional engineer is recommended.

6.2 Design and Construction Data

There are no calculations of value to a stability assessment available for this dam.

6.3 Post Construction Changes

There have been no known post construction changes since the dam was completed in 1974. There are some discrepancies between the design drawings and the dam as discussed in Section 2.4C of this report.

6.4 Seismic Stability

The dam is located in seismic zone No. 2 and, in accordance with the recommended Phase I guidelines, does not warrant seismic analysis.

Section 7: Assessment, Recommendations, and Remedial Measures

7.1 Dam Assessment

(a) Condition

The Clark Site No. 2 Dam is in poor condition at the present time.

(b) Adequancy of Information

The lack of in-depth engineering data precludes a definitive review. Therefore, the adequacy of the dam cannot be assessed from the standpoint of reviewing design and construction data. This assessment is based primarily on the visual inspection, past performance, and sound engineering judgment.

(c) Urgency

The recommendations discussed in Section 7.2 herein should be implemented by the owner immediately upon receipt of this Phase I Inspection Report. The remedial measures should be implemented within one year of receipt of this Phase I Inspection Report except as noted below.

7.2 Recommendations

It is recommended that the owner retain the services of a registered professional engineer to conduct a detailed study of the seepage at the downstream toe and both abutments including the slough area on the downstream slope. The owner should implement the findings of this study.

7.3 Remedial Measures

It is recommended that the owner institute the following remedial measures:

(a) Ensure the operability of the pond drain gate.

(b) Implement and intensify a program of diligent and periodic maintenance including, but not limited to: mowing embankment slopes; backfilling drainage gullies or animal burrows with suitable, well-tamped soil; and clearing debris from spillways, outlets, and slopes.

(c) Implement a program of annual technical inspections of the dam and its appurtenances, including operation of all outlet works.

(d) Immediately develop a plan for surveillance of the project area during periods of intense rainfall and prepare a formal plan for warning the downstream residents and the appropriate officials in the event of an emergency.

7.4 Alternatives

There are no meaningful alternatives to the above recommendations.

APPENDIX A

VISUAL CHECKLIST WITH COMMENTS

Inspection Team Organization

DATE: June 2, 1981

PROJECT: VT00266
Clark Site No. 2 Dam
Topsham, Vermont
VTDWR No. 208-1

WEATHER: Sunny, Warm

INSPECTION TEAM:

Nicholas A. Campagna	Goldberg-Zoino & Assoc.	Team Captain
William S. Zoino	GZA	Soils
Jeffrey M. Hardin	GZA	Soils
Paul Razgha	Andrew Christo Engineers	Structures
Carl Razgha	ACE	Structures

VTDWR Representative Present - Mr. Peter Barranco

NOTE: Mr. Richard Laramie of Camp, Dresser, & McKee, Inc. performed the hydrologic inspection of this dam on May 14, 1981.

CHECKLIST FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITIONS AND REMARKS
DAM EMBANKMENT		
Crest Elevation		1651.9 feet (NGVD)
Current Pool Elevation		1647 feet (NGVD)
Maximum Impound to Date		Unknown
Surface Cracks		None
Pavement Condition		Not applicable
Movement or Settlement of Crest		None
Lateral Movement		None
Vertical Alignment		Good, survey indicates crest is 1.4 to 2.8 feet higher than design.
Horizontal Alignment		Good
Condition at Abutment and at Concrete Structure		Good
Indications of Movement of Structural Items on Slopes		None
Trespassing on Slopes		Minor rutting of crest due to vehicular traffic.
Vegetation on Slopes		Moderate to heavy brush growth on slopes of dam and diversion berm.

CHECKLIST FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITIONS AND REMARKS
Sloughing or Erosion of Slopes or Abutments		Slough on downstream slope, approximately 10 feet square, located 280 feet from left abutment, 25 feet down slope. Serious sloughing of left downstream abutment up to 3 feet deep and 40 feet long.
Rock Slope Protection - Riprap Failure		No riprap, minor surface erosion.
Unusual Movement or Cracking at or near Toes		None
Unusual Embankment or Downstream Seepage		Spring emanating from downstream toe of slope approximately 250 feet from left abutment. Flow is approximately 1 GPM. Clear, minor rust at exits. Seepage from left abutment on the order of 20 to 30 GPM, causing serious sloughing and instability of the toe. The entire downstream toe is wet from the left abutment to the spring. At this point, the flow turns downstream of the toe

CHECKLIST FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITIONS AND REMARKS
		to the outlet channel. Seepage from the right abutment below the diversion berm on the order of 5 to 10 GPM.
Piping or Boils		Some quaking and boiling of toe at left abutment when walked on.
Foundation Drainage Feature		Two 3-foot-diameter concrete ring cisterns are located 56 feet and 460 feet from the left abutment at the downstream toe. The purpose is unclear, but they appear to be for seepage collection. After pumping out the infiltration, rates were less than 1 GPM at the left cistern and 1 GPM at the right cistern.
Toe Drains		8-foot-wide by 4-foot-high trench drains near the downstream toe. 6-inch-diameter perforated pipe for 80 feet to either side of the pond drain outlet. No flow emanating from either pipe.
Instrumentation System		None

CHECKLIST FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITIONS AND REMARKS
EMERGENCY SPILLWAY		
Channel		Good, except heavy brush growth.
Diversion Berm		Good, except heavy brush growth.
Principal Spillway Intake		Good
Principal Spillway Outlet		Good
Pond Drain Inlet		Submerged
Pond Drain Outlet		Good

APPENDIX B

ENGINEERING DATA

NOTES:
1) Page B-3 of this appendix represents the results of a limited level survey conducted by the inspection party. Distances were measured by taping.

2) Pages B-4, B-5, and B-6 are reduced copies of the original design drawings. Some discrepancies, such as the location of the emergency spillway, were noted between these design drawings and the existing dam.

14. Alignment appears OK - but toe line irregular due to erosion and piping (?)

15. Movement See #3. Some slumping or subsidence.

16. Remarks Condition of slope is of some concern.

. Crest

1. Vegetative Cover good grass cover but some brush up to ½" ϕ starting to grow

2. Erosion none significant

3. Evidence of Overtopping none

4. Settlement, Cracks none observed

5. Animal Burrows none observed

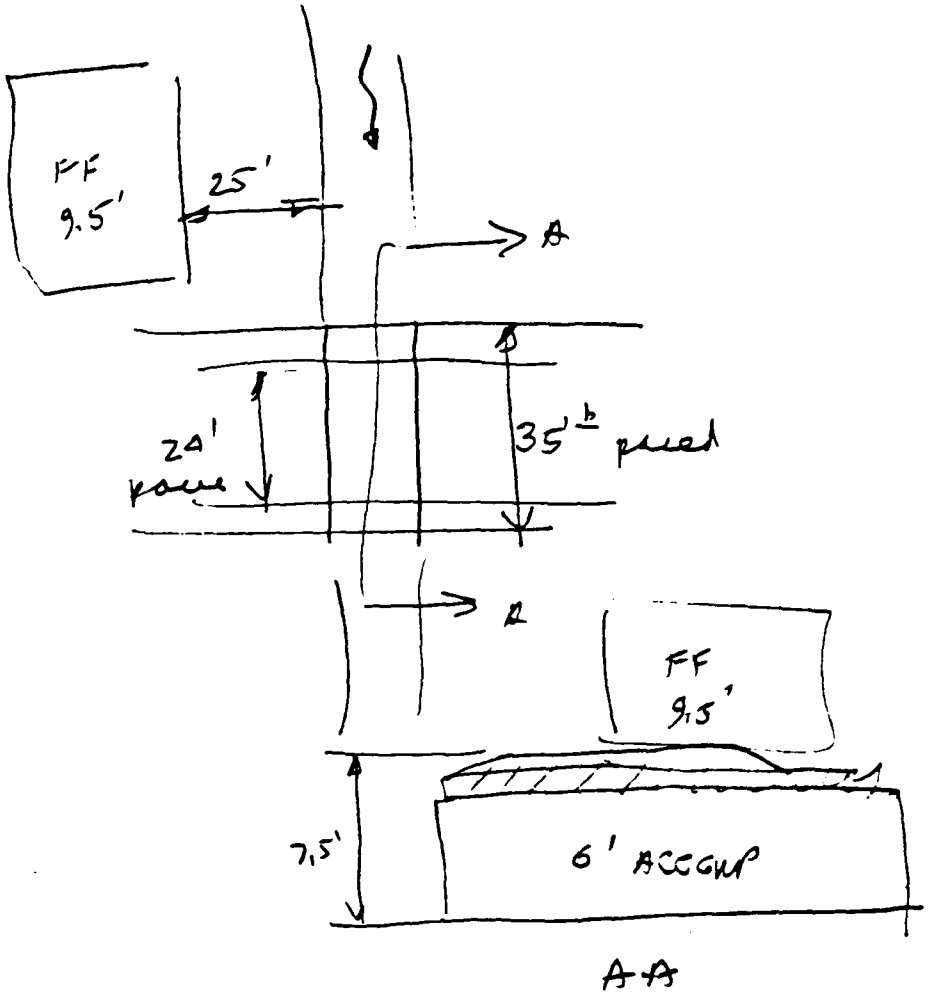
6. Debris none

7. Use of crest (road, trail, etc.) some evidence of vehicular access

8. Structural no structural items

9. Abutments OK

D/S channel @ East Topsham Village



B. Downstream Face or Slope and Toe

1. Vegetative Cover Varies. Good grass cover to sparse.

2. Erosion Significant at both contacts. Minor along much of crest line & minor along slope.

3. Slumps, Slides, Cracks Scarp like feature above D/S outlet, some subsidence. Some above seep 190' left of outlet (See drawing). Left toe acts like "bulls liver".

4. Animal Burrows few mole sign

5. Slope Protection none except grass

6. Debris none

7. Seepage Substantial seepage along entire toe line. (See drawing)

8. Piping None observed but deposits @ toe & erosion ~~into~~ toe indicate ~~past~~ piping probably has occurred

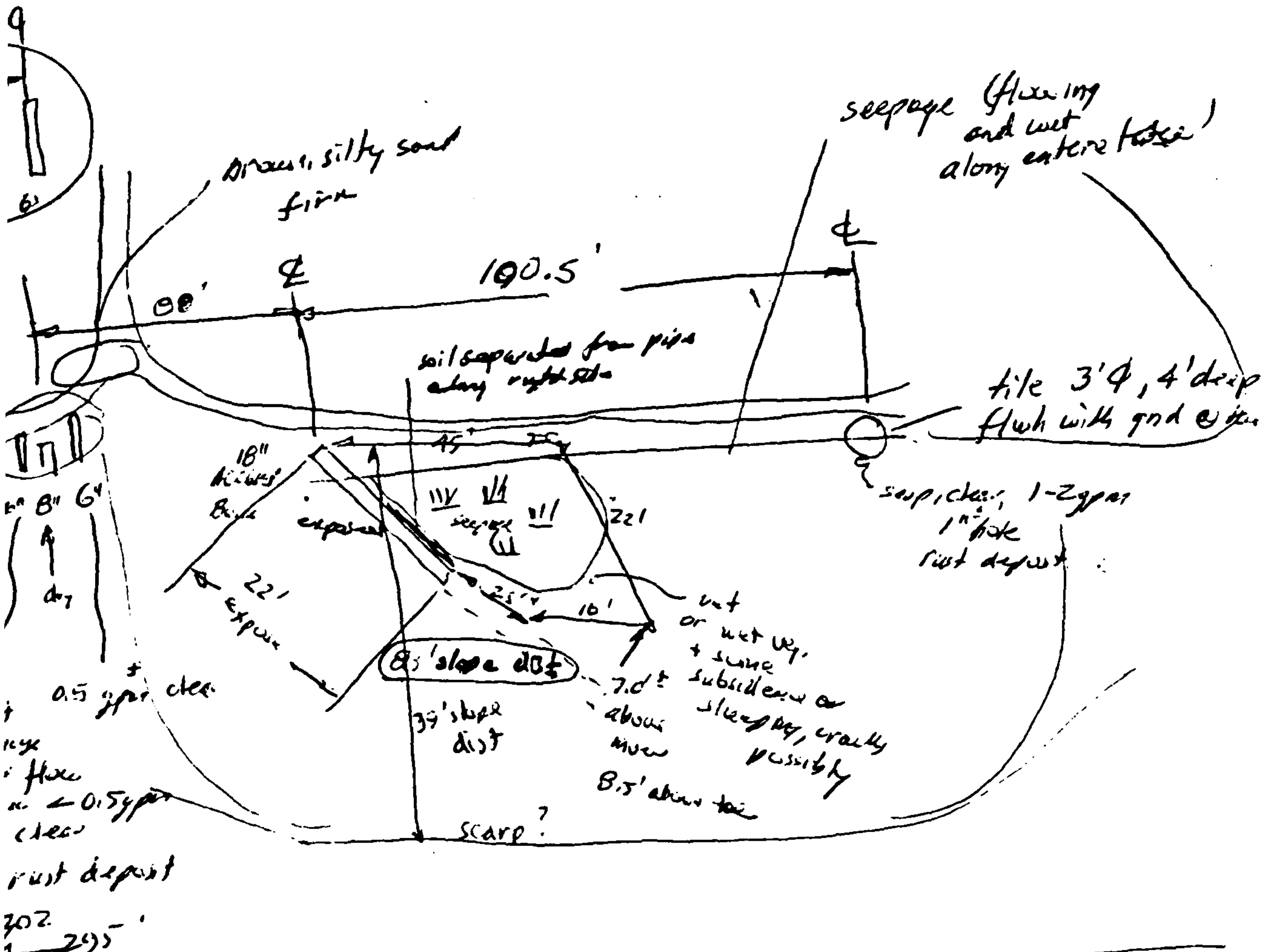
9. Boils None evident, but a spring @ right cistern is flowing under enough pressure to carry soil.

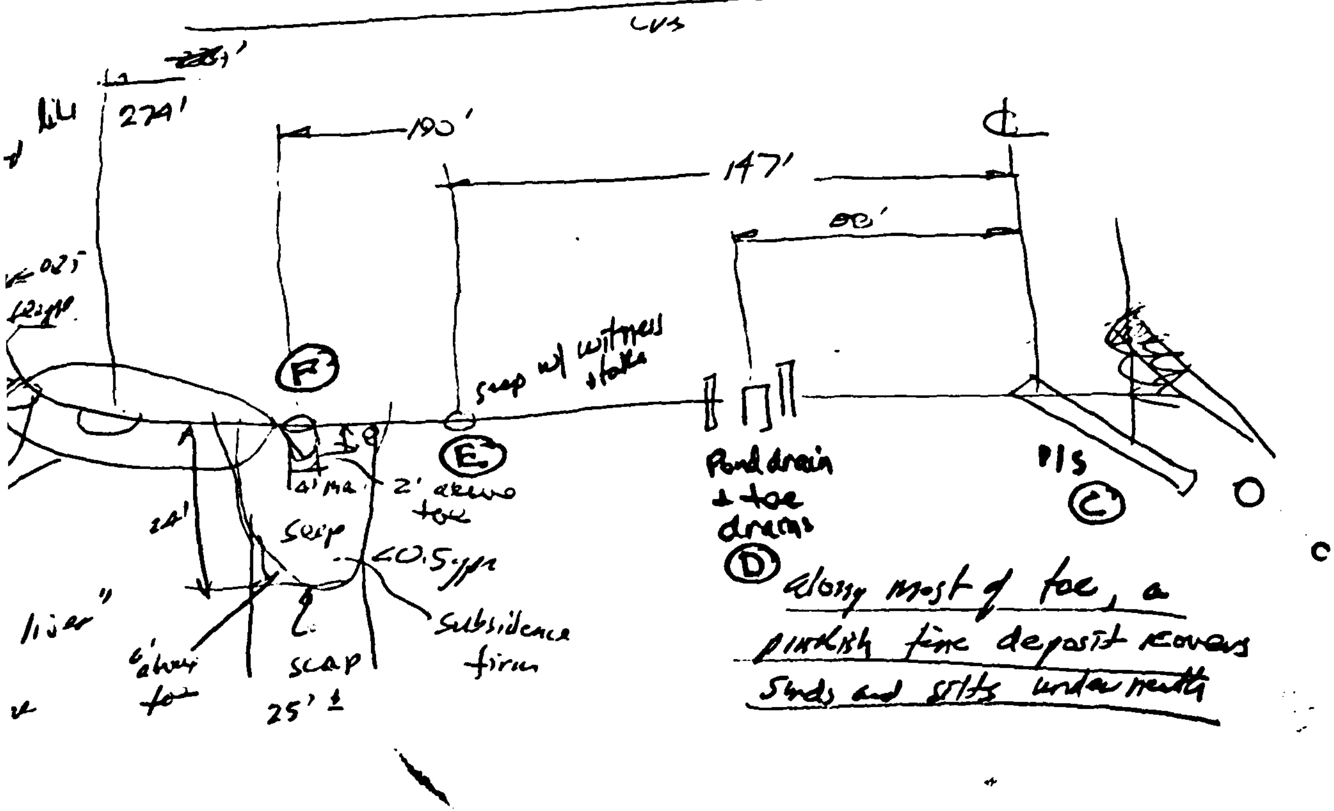
10. Toe Drains Both clear, rusty deposits, both flowing. ~~Eyelet under flowing~~ No rodent guards.

11. Scour Some at plunge pool.

12. Structural no structural items

13. Abutments Rt d/s @ E/S dike: erosion. Some @ left.


seepage (flowing and wet along entire toe)
brown silty sand firm
190.5'
soil separated from pipe along right side
tile 3' ⌀, 4' deep flush with grd @ toe
seep, clear, 1-2 gpm
1" hole
rust deposit
18"
exposed
seepage
22'
25'
10'
wet or wet veg. + some subsidence or sloughing, cracks possibly
8.5' slope dist
39' slope dist
7.0' above
8.5' above toe
0.5 gpm clear
< 0.5 gpm
clear
rust deposit
scarp?
295'


274'
190'
147'
80'
seep w/ witness stake
F
E
2' above toe
Pond drain + toe drains
D
P/S
C
24'
seep
< 0.5 gpm
subsidence firm
scarp
25' ±
along most of toe, a pinkish fine deposit covers sands and silts underneath

. Condition of Main Structure

Type of Construction E/F

A. Upstream Face or Slope

1. Vegetative Cover good grass cover but small brush (≤ ½"ϕ) starting to grow - particularly @ right end
2. Erosion none significant
3. Slumps, Slides, Cracks none observed
4. Animal Burrows none observed
5. Slope Protection vegetated
6. Debris none
7. Structural no structural items
8. Abutments OK
9. Alignment OK
10. Movement none apparent
11. Remarks Avent in good condition. U/S slope should be mowed to control brush.

State of Vermont
Agency of Environmental Conservation
Department of Water Resources
Montpelier, VT 05602

DAM INSPECTION REPORT

ame CLARK DAM (SITE #2) DWR No. 208-1

own Topsham NDS No. VT00266

wner Gordon H. Clark Inspection Date 10-10-80

ddress Newton Road, Woodbridge Connecticut 06525 Last Inspected -74

elephone _____ Hazard Class 2

Size Category III

ERSONS PRESENT AT INSPECTION (Name and Organization):

nspecting Party A.P. Barranco, Jr. -DWR

)thers _____

. General Conditions at Time of Inspection

Weather Clear, 45°, Dry Ground Conditions Dry

Water Surface Elevation @ crest of riser Datum _____

Accessibility fully accessible

Reservoir Area undeveloped.

Remarks _____

check current owner

VERMONT DEPARTMENT OF WATER RESOURCES

INFORMATION SHEET

Name of Dam Clark Site 2 Town Topsham

Owner Gordon Clark Name of Stream Tabor Branch Trib.

Address _____ Classification II

U.S.G.S. Coordinates: Lat. 44°-9'-22" Long. 72°-13'-12"

U.S.G.S. Map Groton VT Aerial Photos 11-32-120 & 121

U.S.G.S. Elev. @ Spillway _____

Total Length of Dam 720' * Crest Width of Emergency Spillway 35'

Width of Top 28' Maximum Height 34.8'

Spillway Capacity: Principal 24 cfs ** Emergency 77 cfs **

Pond Area 8.5 ± Acres ** Drainage Area 145 Acres **

Pond Volume: Normal Water Level 60 ± AF ** Design High Water Level 78 AF estimated

Maximum Water Depth: Normal Water Level 23.7' Design High Water Level 25.7'

Storage Before Emergency Spillway is Used ~29 AF

Use of Reservoir Private Recreation

Description of Dam: homogeneous earth fill w/ 3:1 u/s slope & 2:1 d/s slope

Description of Spillway(s): PS - 24" ϕ Bcomp riser w/ 18' ϕ Bcomp barrel
E.S. - earth cut w/ 2:1 side slopes.

Designed by SCS Year Built 1974

Hearing Date Sept 7, 1973 Order Date Nov 6, 1973

Additional Remarks: * including E.S.; ** from SCS design book

WR 44

.I.

from the office of

Selectmen ☐
Town Clerk ☐
Treasurer ☐
School District ☐
Tax Collector ☐

Town of Topsham

V E R M O N T

in answering, address reply to . . .

Ruth E. Morrison, Town Clerk

West Topsham, Vt. 05086

15 November 1973

Ms. Catharine Bothwell
Executive Secretary
Water Resources Board
Montpelier, Vermont
05602

Dear Ms. Bothwell:

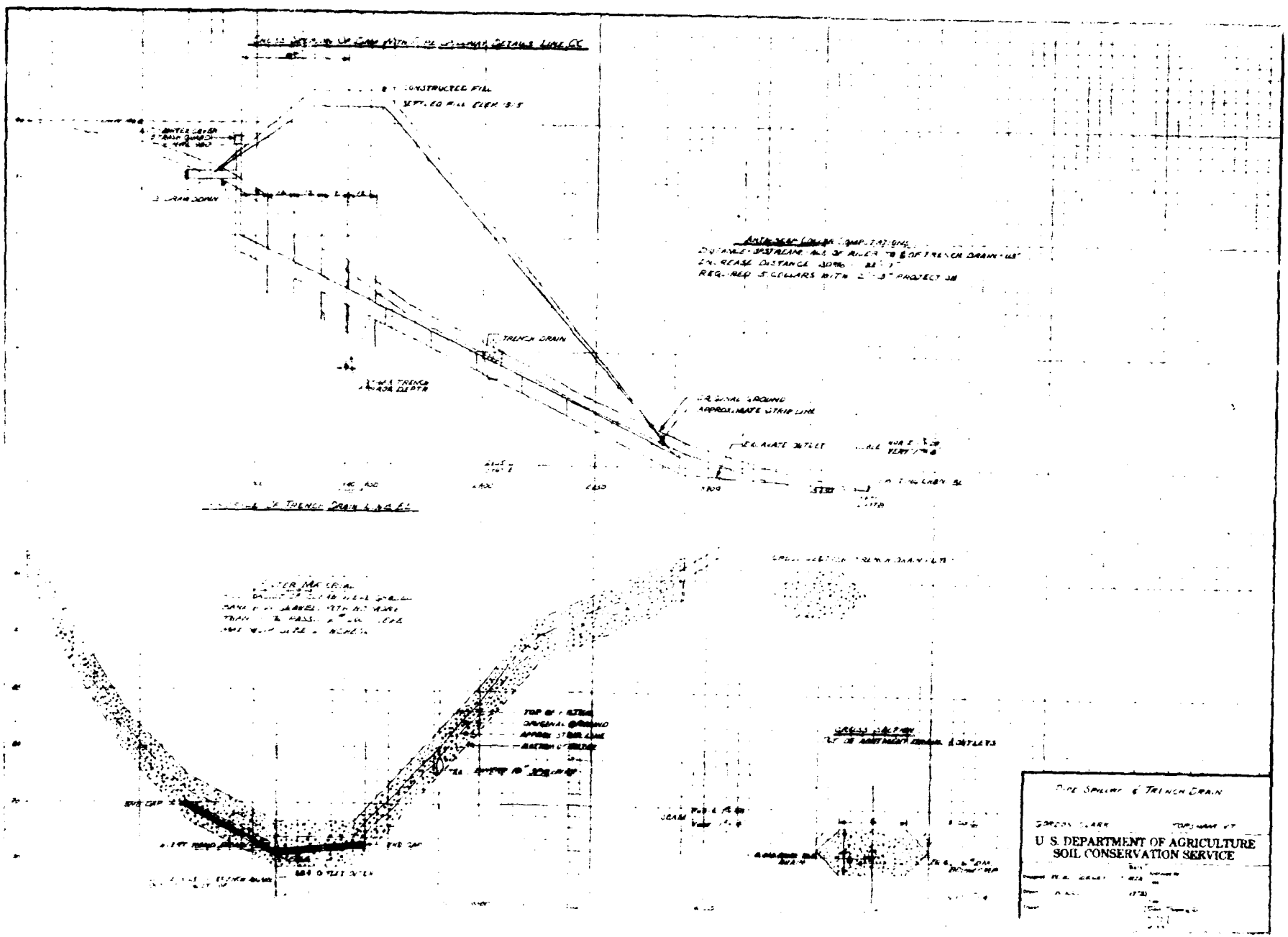
The order authorizing Mr. Gordon H. Clark to construct a dam on an unnamed tributary of the Tabor Branch of the Waits River in the Town of Topsham received 2:30 pm this date 15 November 1973, and filed in the Town Office of Topsham.

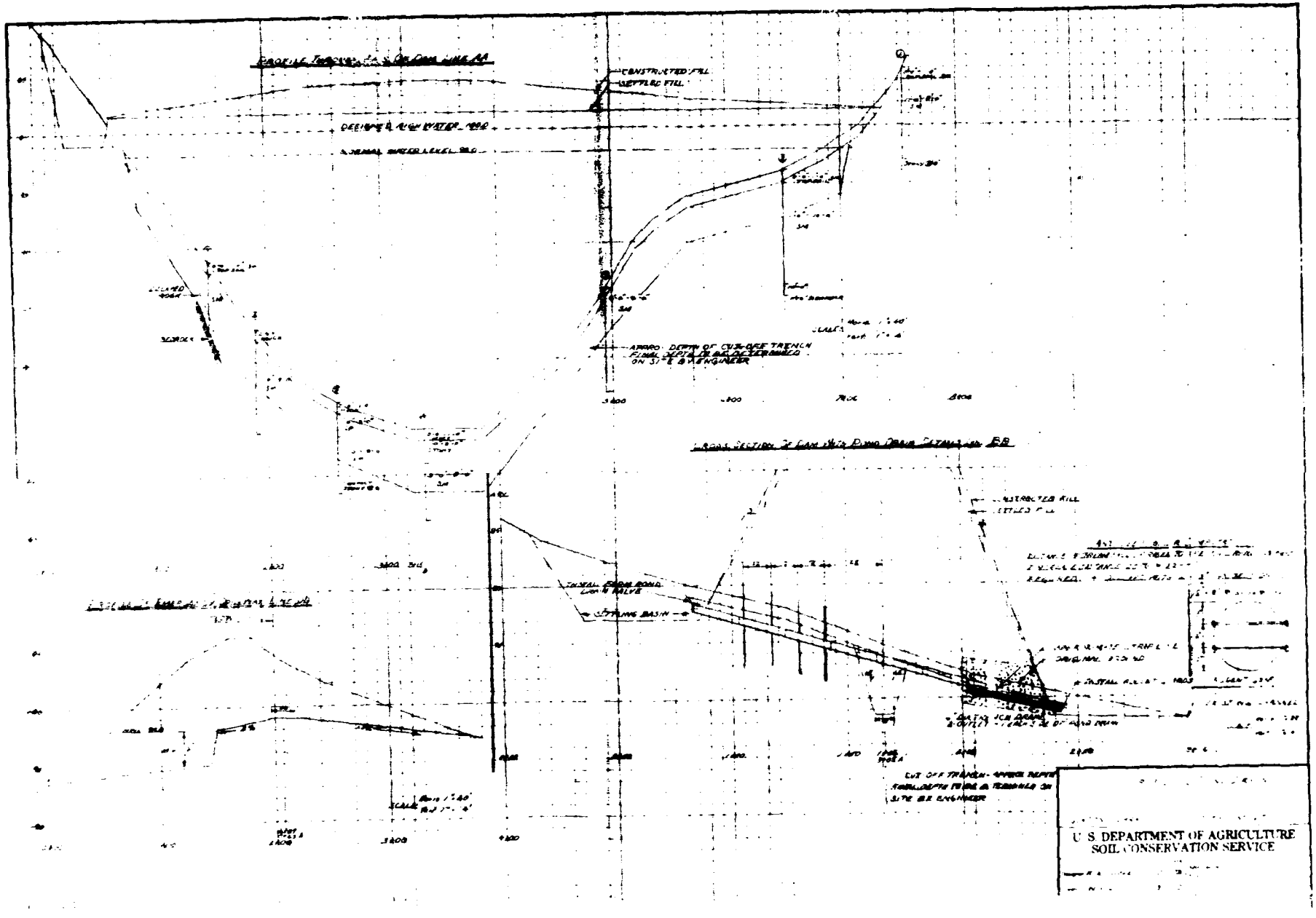
Sincerely,

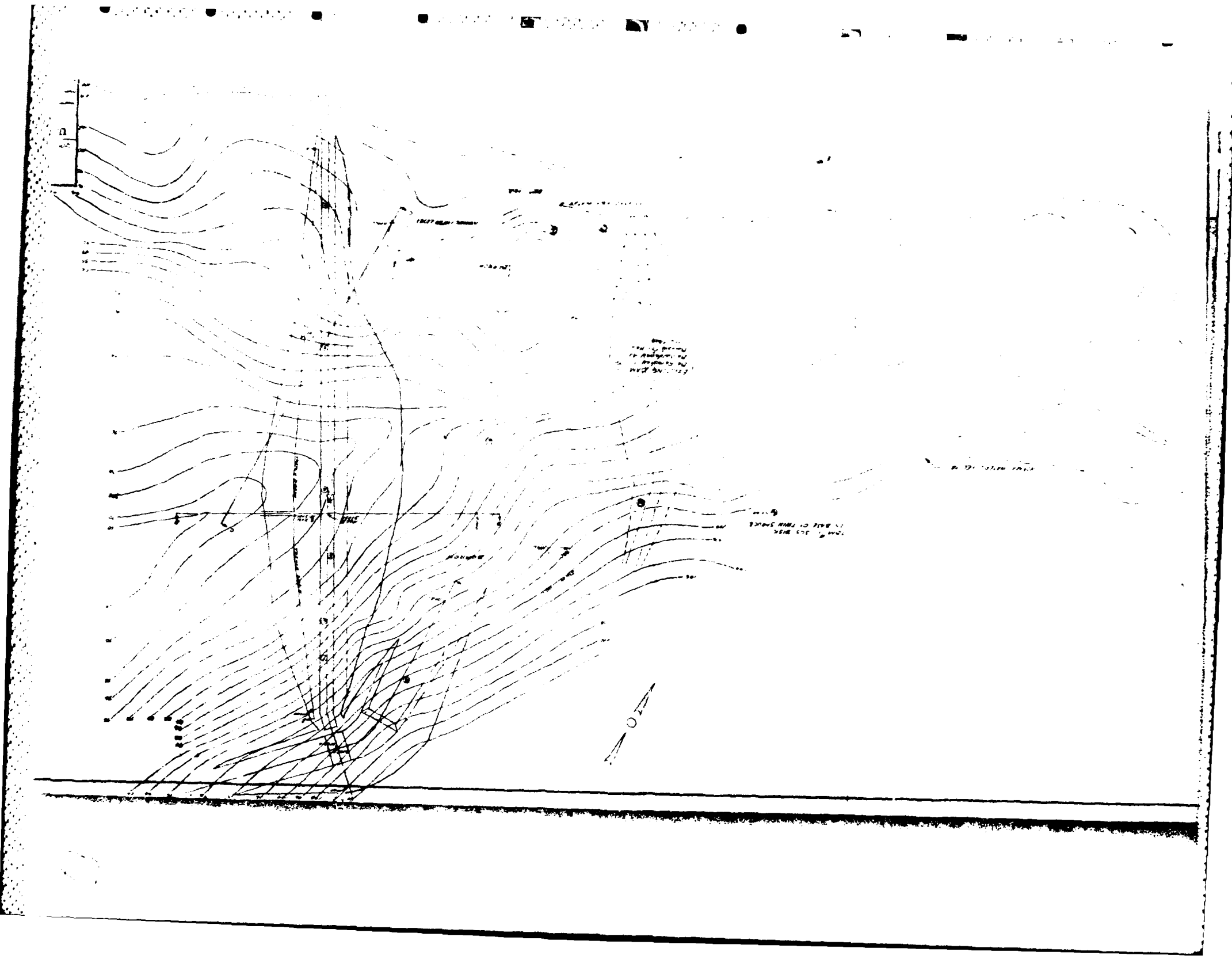
Ruth E. Morrison

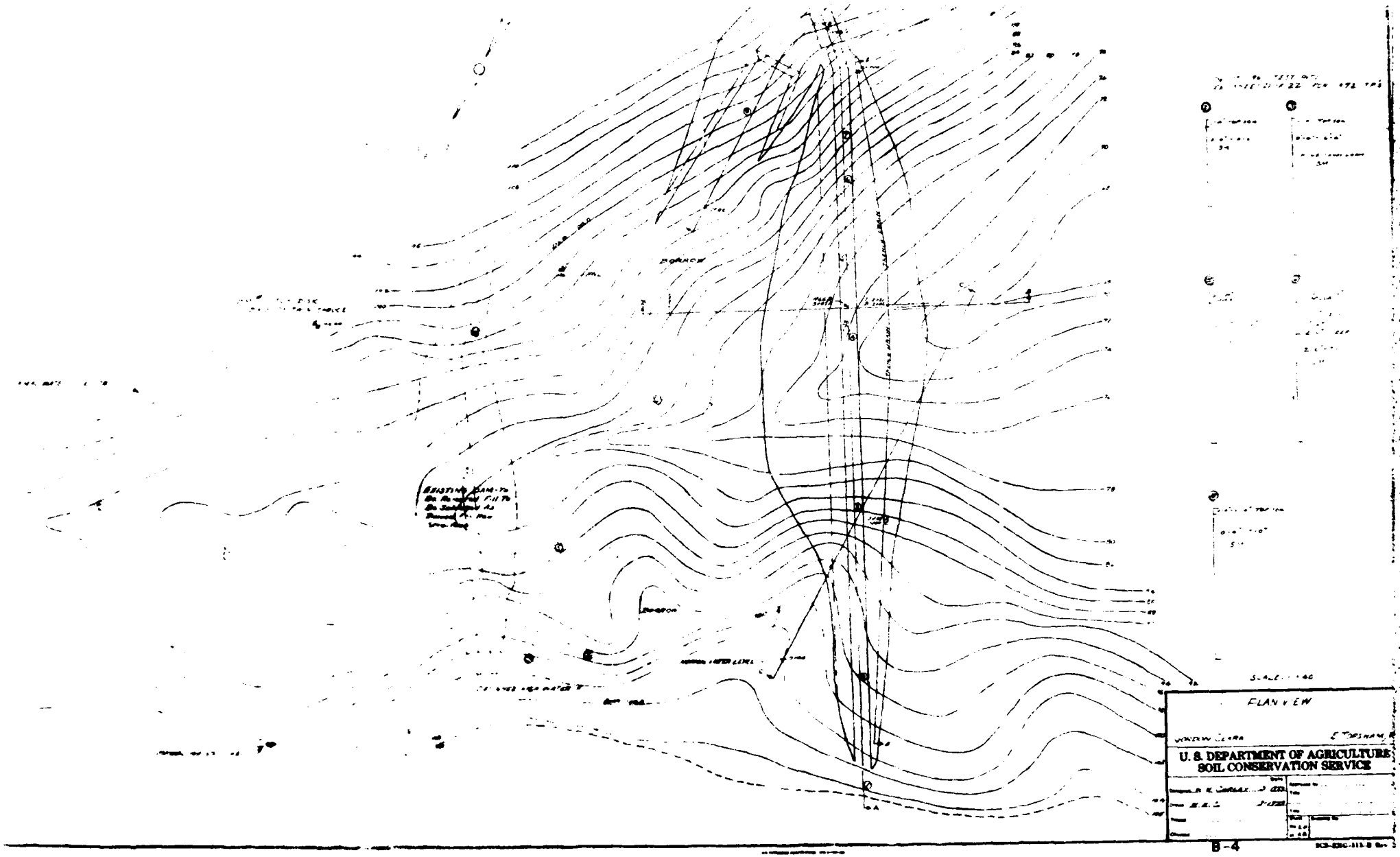
Ruth E. Morrison (Mrs.)
Town Clerk of Topsham

Encl.


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

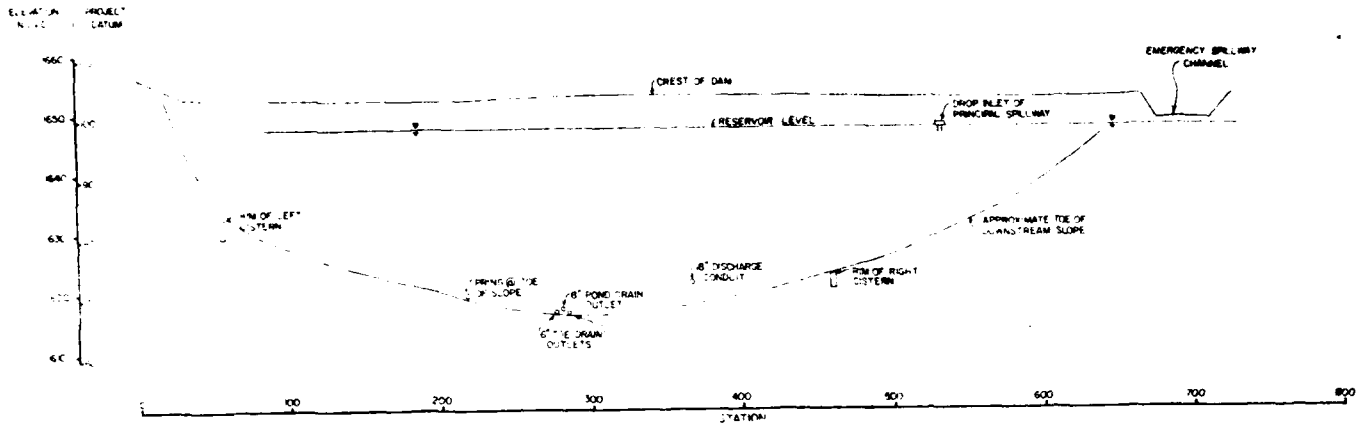

CONSTRUCTED FILL
SETTLED FILL
DESIGNED HIGH WATER
NORMAL WATER LEVEL
APPRO. DEPTH OF CUT-OFF TRENCH
FINAL DEPTH TO BE DETERMINED
ON SITE BY ENGINEER
CONSTRUCTED FILL
SETTLED FILL
TRAVEL FROM ROAD
CONTROL VALVE
STILLING BASIN
CUT OFF TRENCH - APPROX DEPTH
FINAL DEPTH TO BE DETERMINED
ON SITE BY ENGINEER
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE





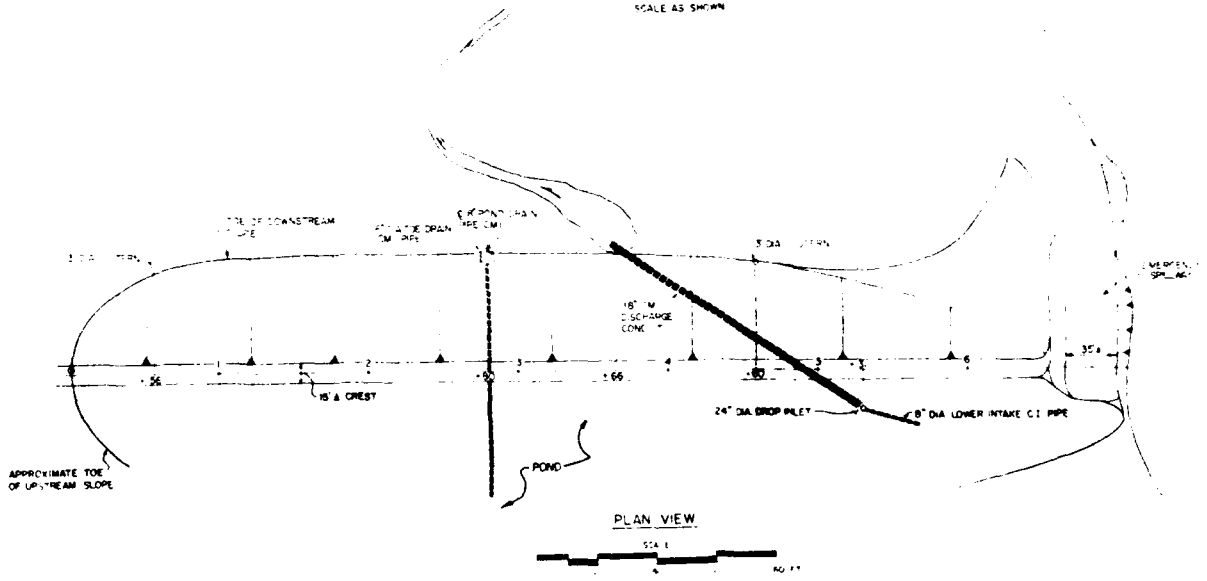
PLAN VIEW

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE



CROSS SECTION

SCALE AS SHOWN



PLAN VIEW

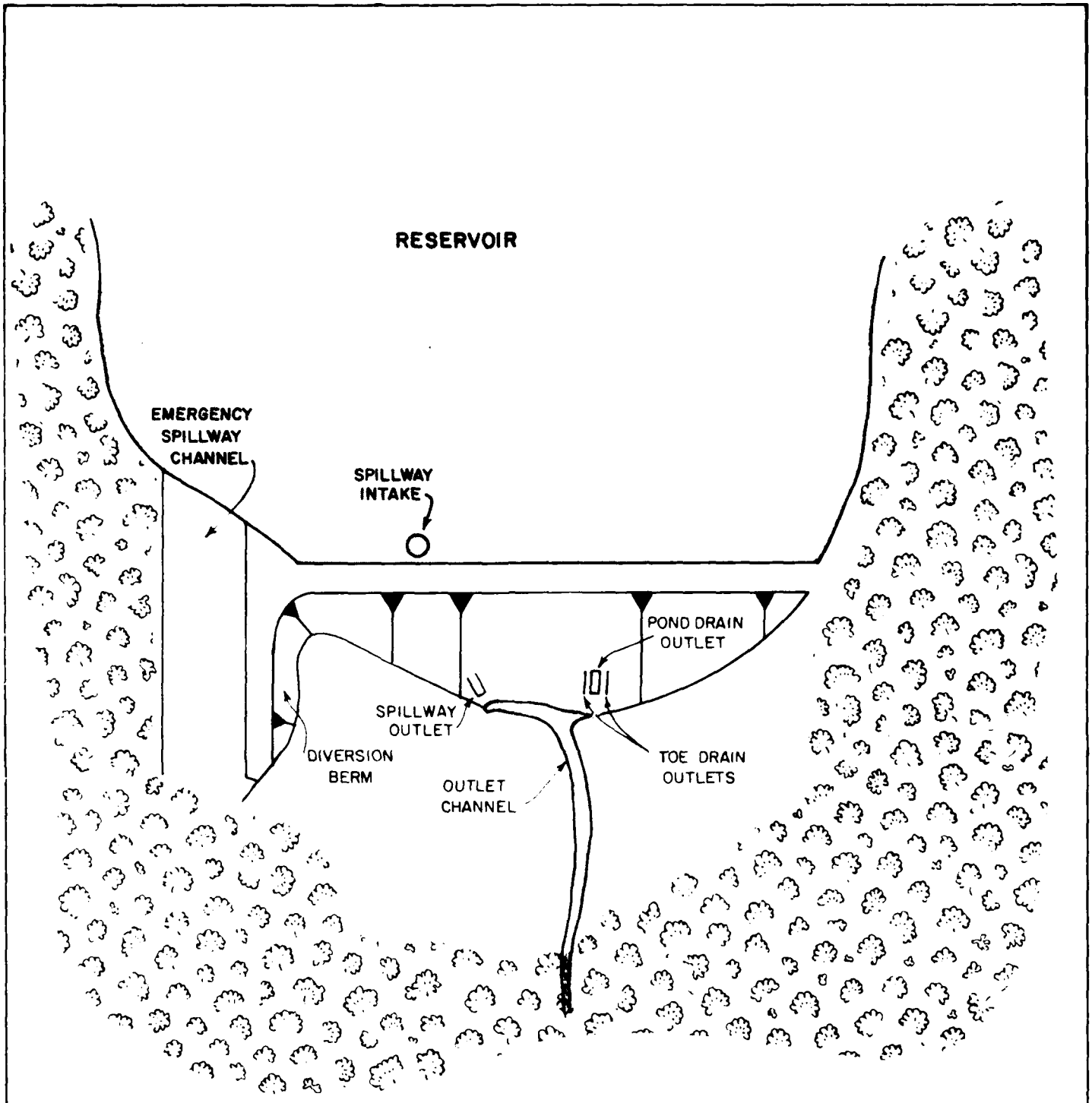
SCALE

GOLDBERG ZOINO & ASSOCIATES, INC.
GEOTECHNICAL GEOHYDROLOGICAL CONSULTANTS
NEWTON UPPER FALLS, MASSACHUSETTS

U.S. ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

PLAN AND SECTION OF DAM



GOLDBERG ZOINO & ASSOCIATES, INC
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS
NEWTON UPPER FALLS, MASSACHUSETTS

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SITE PLAN

FILE No 2605

CLARK SITE No. 2 DAM — TOPSHAM, VERMONT

SCALE NOT TO SCALE

DATE JULY 1981

10. Alignment OK

11. Remarks Overall in good condition. Needs mowing

III. Condition of Outlet Works

A. Principal Spillway

Type pipe riser and barrel

Controlled or Uncontrolled uncontrolled

1. Approach Channel N/A

2. Transition N/A

3. Control Section clear

4. Discharge Channel

5. Intake Structure N/A

6. Conduit not visible except at crest of riser and outlet. last 22' of conduit partially exposed.

7. Outlet Structure

8. Trash Racks OK

9. Anti-vortex Devices OK

10. Stop Logs, Flash Boards N/A

11. Remarks No apparent structural problems with pipe from what can be seen.

B. Emergency Spillway

Type vegetated earth cut

Controlled or Uncontrolled uncontrolled

1. Approach Channel clear of major obstructions

2. Transition clear " "

3. Control Section clear " "

4. Discharge Channel clear " "

5. Remarks Poor to non-existent grass cover. Many small (4"-12" high) balsam and spruce seedlings + brush.

C. Drawdown Facilities, Gates, Drains, Appurtenances, Etc.

1. Drawdown Facility none visible but apparently has standard SCS flap valve

Condition

2. Other Gates, Drains, Appurtenances N/A

Condition

3. Remarks

IV. Operation and Maintenance

Apparently has not been mowed in a couple of years from size of brush growing. Weeds receeding and mulching in places.

V. Inspection Summary

A. Information Obtained

1. Photographs ✓
2. Dimensions some
3. Other

B. Additional Information Needed

As built needed (EIS location + its dike / training wall). Construction check by SCS & DWR in file but need more info.

C. Overall Condition of Dam

Fair but d/s slope, toe and seepage is of serious concern.

VI. General Comments

This dam should be watched closely. Seepage problem should be investigated ASAP.

Report By A. Peter Bernard Date 10/14/80

Attachments:

1) Photos (when developed)
2) Sketch of seepage / sloughing

D/S Hazard Class 2

2 houses in East Topsham village adjacent to brook. First floors ≈ 9.5' ± above brook bed.

SCS-346 5-57

FARM POND PLAN

EXHIBIT NO. 4

SEP 06 1973

PROJECTING WATER RESOURCES BOARD

Cooperator: GORDON CLARK

Location: EAST TOPSHAM VT.

DESIGN DETAILS

Drainage Area		145 Acres
Design Runoff		75.4 CFS
Pond Area	NWL	8.5± Acres
Reservoir Capacity	NWL	60± Acres - Ft.
Reservoir Capacity	approx.	19549728 Gallons
Pipe Spillway Capacity		CFS
Vegetated Spillway Capacity		77 CFS

Woodsville Quadrangle VERMONT

Latitude 44° 09' 22" Longitude 72° 13' 15"

MATERIALS

Item	Quantity	Unit		

Approved

John W Bryant Asst. State Cons Engr 3/30/73

Area Conservationist Engineer

Date Date Date

REFERENCE	U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ASSISTING SOIL CONSERVATION DISTRICT	DRAWING NUMBER SHEET 1 OF 22 DATE

VT-ENG-29a Rev. 1/73 USDA-SCS

STAPLE NOTES HERE

SURVEY NOTES

SOIL LOSS

CONSTR. CHECK

POND DESIGN

COOPERATOR Gordon Clark
SITE LOCATION Townsend, Vt.
PHOTO MAP NUMBER Vt-12 4-225'
POND PURPOSE Recreation

REAP YEAR ——

SOILS:
DAM ABUTMENTS
DAM FOUNDATION
POND BASIN
BORROW AREA

WATERSHED AREA 142
POND SURFACE AREA
POND CAPACITY

PIPE SPILLWAY
Q (Req.) 24 CFS
Q(Des.) CFS
d= 28 "
Hx= 1 '
H= 27 '
L= 120 '
Riser "Dia.
Barrel "Dia.

Recommended Pipe Spillway Size

WSA	BARREL DIA.	RISER DIA.
0-5	4" or NONE	6", 4" or NONE
5-10	6"	8"
10-20	8"	10"
20-30	10"	12"
30-50	12"	15" or 18"

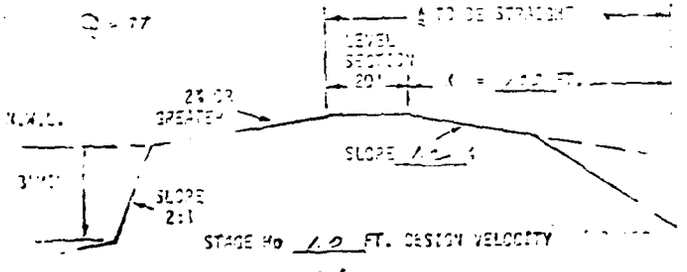
EMERGENCY SPILLWAY

PEAK DESIGN INFLOW RATE 145 CFS (TR50-VT-ENG-20a)

STORAGE RATIO = WATERSHED AREA / POND SURFACE AREA = 145 / 50 =

DESIGN CAPACITY 145 CFS x 52 % = 75.4 CFS

EMERGENCY SPILLWAY PROFILE



STAGE Ho 1.0 FT. DESIGN VELOCITY

BOTTOM WIDTH 34 FT.

SLOPES : 1 , :

MATERIALS

ITEM	QUANTITY	UNITS	REFERENCED SHEET
CLEARING AND GRUBBING	5.0	ACRES	
STRIPPING	1.5	ACRES	DAM FOUNDATION
EXCAVATION		CU.YDS.	
EARTH FILL	30,000	CU.YDS.	
FILTER MATERIAL	500	CU.YDS.	
RIPRAP		CU.YDS.	
CONCRETE		CU.YDS.	

PRINCIPAL SPILLWAY QUANTITIES SEE REFERENCE SHEETS 13, 14, 15, 16, 17, 18, 19, 20, , ,

VEGETAL RECOMMENDATIONS
SEED (LBS/ACRE)

10 #	KENTUCKY BLUEGRASS	#	TALL FESCUE
10 #	REDTOP	#	TIMOTHY
10 #	EMPIRE TREFOIL	#	
#	REED CANARY	#	
#	RED FESCUE	#	

	RATE	ACRES	$ UNIT
MULCH - HAY OR STRAW			
LIME - TO A pH OF 6.5			
FERTILIZER - 10-20-10 FORMULA			

CONSTRUCTION NOTES

	NAME	TITLE	DATE
DESIGNED BY:	[illegible]	S.C.S.	3-15-73
APPROVED BY:	[illegible]	Engineer	4-10-73

Constructed according to design and specification except ... grade exceptions meet standards and specifications.

NAME: TITLE: DATE:

REFERENCE Engineering Field Manual for Conservation Practices	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE NATURAL RESOURCES ...	DRAWING NUMBER VT-ENG-29a SHEET OF SHEETS 1973

RTSC-NE-ENG-230
Feb. 1970

U. S. Department of Agriculture
Soil Conservation Service

PEAK RATES OF DISCHARGE FROM SMALL WATERSHEDS

State VERMONT
County ORANGE
Cooperator GORDON CLARK
Community EAST TOPSHAM, VT.

Sheet No. ___ of ___
Field No. ___
Computed by H.M Date 3-1973
Checked by WHC Date 5-1973

Drainage Area is 145 Acres.
Rainfall Freq. is 50 Years.

Rainfall Depth is 5.0 Inches.
Avg. Watershed Slope is 16 Percent.

Hydrologic Soil Group 1	Land Use 2	Treatment or Practice 3	Hydrologic Condition 4	Runoff Curve Number 5	Area (Ac.) 6	Col. 5 X Col. 6 7
B	WOODL.	NONE	GOOD	55	40	2200
"	PAST.	"	"	61	50	3050
C	WOODL.	"	"	70	20	1400
D	WOODL.	"	"	77	35	2695
				TOTALS =	145	9345

Weighted Runoff Curve No. = $\frac{\text{Total Col. 7}}{\text{Total Col. 6}} = \frac{9345}{145} = 64.45$; Use 64.0

Q_1 (For 55 RCN_1) = Q(ES 1027 for STEEP slopes) x Slope Correction Factor (Ex. 2-0)

= 105 x 1.00 = 105 cfs

Q_2 (For ___ RCN_2) = 155 x 1.00 = 155 cfs

Watershed RCN Minus RCN_1	C
1	.2
2	.4
3	.6
4	.8

$Q_2 - Q_1$ = 155 - 105 = 50 cfs

$\Delta Q = (Q_2 - Q_1) \times C$ = 50 x .8 = 40 cfs

Peak Discharge = $Q_1 + \Delta Q$ = 105 + 40 = 145 cfs

Runoff = 1.58 Inches (Exhibit 2-7A)

NOTE: Q_1 and Q_2 above refer to runoff resulting for RCN's to nearest 5 (60, 65; 65, 70, etc.). If computed RCN ends in 0 or 5 (60, 65, 70, etc.), Q_2 and the next three lines will not be needed. In this case, Q_1 runoff will be the Peak Discharge.

Runoff Data Sheet

Sheet 4 of 22

USDA-SCS-HYATTSVILLE, MD. 1971

3-1978

SCS-ENG-342
REV. 1-71
Earth Fill Computations
Using Center Height Method

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

14' TOP WIDTH 3:1 & 2:1
Strip Line to 101.5 designed elevation

By: Gordon Clark 12-7

(1) Station Feet	(2) Ground Elev. Feet	(3) Center Heights of Embank. Feet	(4) Volume of Embank. Cu. Yds. / Ft.	(5) Summation Volume	(6) Average Volume (5) ÷ 2 Cu. Yds. / Ft.	(7) Distance Between Sta. in Feet	(8) Volume of Embank. (6) x (7) Cu. Yds.	
[illegible]		0.0	0.0					
				1.4	0.7	4	2.8	
[illegible]7		2.0	1.4					
				22.4	11.2	73	817.6	
[illegible]		12.5	31.0					
				87.3	44.65	92	4107.8	
[illegible]		24.5	68.3					
				147.1	73.55	35	2574.3	
[illegible]		26.5	78.9					
				168.8	~~84.4~~ 84.6	48	~~4051.2~~ 4060.8	
[illegible]		28.5	90.0					
				180.0	90.0	71	6390.0	
[illegible]		28.5	90.6					
				146.6	74.3	64	4755.2	
[illegible]		22.5	58.6					
				79.6	39.8	68	2706.4	
[illegible]		12.5	31.6					
				32.1	16.05	47	754.4	
[illegible]		8.5	11.1					
				18.4	9.2	82	754.4	
[illegible]		4.5	7.3					
				11.5	5.75	40	230.0	
[illegible]		11.5	4.2					
				4.2	2.1	48	100.8	
[illegible]		0.0	0.0				~~27245~~	
							~~27241~~	Cu. Yds
					10%		~~2735~~	
							~~29980~~	

B-22

CONSTRUCTION SPECIFICATIONS

Number 1
SITE PREPARATION

I. Clearing and Grubbing. The area to be covered by the reservoir below the normal water line, the structure site, and borrow areas shall be cleared of all trees, brush, fences, and other objectionable material. Within the limits of the dam and appurtenances and the borrow area, stumps, roots, and other objectionable material shall be removed, ~~to a depth of _____ inches below the ground surface.~~ On the remaining specified area, all trees, brush, and stumps shall be cut off approximately level with the ground surface.

II. Stripping. The area to be covered by the earth embankment and the surface of the borrow area shall be stripped of all grass, roots, vegetative materials, objectionable soil or other objectionable materials to a depth that will insure the removal of any materials which will prevent bond between the foundation and the fill.

III. Disposal. Trees, stumps, debris, and spoil removed in the clearing and stripping operations shall be disposed of outside the area to be occupied by the dam and reservoir, as directed by the owner or his representative. Sufficient topsoil is to be stockpiled in a convenient location for use on the embankment and other disturbed areas to facilitate seeding.

APPROVED: [signature] HEAD OF E. & W.P. UNIT DATE 1-60

REFERENCE	U. S DEPARTMENT OF AGRICULTURE	DRAWING NO.
GORDON CLARK E. TOPSHAM, VT.	SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	ESNE-75 SHEET 6 OF 22 DATE JAN., 60

CONSTRUCTION SPECIFICATIONS

Number 2
EARTH FILL

I. Scope. This item shall include the excavation, transportation, and placement of materials and the performance of other operations in connection with the construction of the earth fill dam as shown on the drawings or as herein specified.

II. Material. The material for the fill shall be obtained from the designated areas. The material shall be free from stumps, wood, brush, roots, sod, rubbish, and other matter that may decay. It should also be free of stones over two (2) inches in diameter where compacted by hand or mechanical tampers, or over six (6) inches in diameter where compacted by rollers or other equipment. Frozen material shall not be placed in the fill, nor shall the fill material be placed on a frozen foundation.

III. Preparation of Foundation. Upon completion of the stripping operation and just prior to placing the fill material on any portion of the foundation, that portion shall be scarified, plowed, or disked to a depth of three (3) inches. All objectionable material exposed by this operation shall be disposed of outside the limits of the fill.

IV. Core Trench. Where specified, a core trench shall be excavated along or parallel to the central axis of the earth fill as shown on the plans. The width of the trench shall be governed by the equipment used for excavation, with the minimum width being four (4) feet.

If a core trench is needed the minimum depth shall be three (3) feet or the depth shown on the plans. If large boulders or bedrock is encountered in the excavation, the minimum depth will not be required if, in the opinion of the Engineer, the trench cannot be excavated to the required depth. The rock or boulders shall be cleared of all materials to insure adequate bonding of backfill material to the rock. The side slopes of the trench shall be 1 on 1 or flatter.

The backfill material for the core trench shall be the most impervious material available and shall be compacted with equipment or rollers to assure maximum density and minimum permeability. Where rock is encountered, the fill material shall be placed in three-inch layers and compacted by hand or mechanical tampers. The fill material shall contain sufficient moisture to insure adequate bonding to the rock. Backfilling shall continue in three-inch layers until the depth of fill over the rock is such that acceptable density may be obtained by using construction equipment with a maximum of six-inch layers for the compaction operation.

SHEET - 2 of 3

APPROVED [illegible] HEAD OF E. & W.P. UNIT DATE 1-60

REFERENCE	U.S. DEPARTMENT OF AGRICULTURE	DRAWING NO.
GORDON CLARK E. TOPSHAM, VT.	SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	ESNE-76 SHEET 1 OF 3 DATE JAN, 60

CONSTRUCTION SPECIFICATIONS

Number 2
EARTH FILL

V. Imbedded Conduits. Imbedded conduits shall mean pipes installed for the purpose of draining the reservoir, pipe spillways, pipes for stock watering developments, or other pipes or conduits installed or existing under the fill.

Excavation for conduits shall be made to grades and lines shown on the plans or as indicated by construction stakes. Care should be taken not to excavate below the depths specified. Excavation below grade shall be corrected by placing firmly compacted layers of earth to provide a good foundation. If rock or boulders are exposed in the bottom of the excavation, they shall be removed to a minimum depth of eight (8) inches below the invert grade of the pipe and the excess excavation replaced with firmly compacted earth to the specified grade.

The pipe shall be installed and the excavation backfilled as specified in paragraph VIII before starting the placement of the earth fill.

VI. Placing and Spreading Material. The placing and spreading of material shall be started at the lowest part of the section under construction and the fill carried up in layers of six (6) inches. The layers shall slope slightly towards the reservoir to prevent puddles and provide for faster runoff in case of rain. Where possible, the layers should extend over the entire area of the fill. The distribution and gradation of the materials throughout the fill shall be such that there be no lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material. The most porous borrow material shall be placed on the downstream portions of the embankment.

VII. Compaction. Each layer of fill material shall be compacted by routing the construction equipment so that all parts of each layer are equally compacted. Bulldozers, carry-alls, trucks, farm tractors, or rollers may be used for the compaction. Fill material should contain sufficient moisture so that it can be formed into a ball without crumbling. If water can be squeezed out of the ball, it is too wet to compact properly.

VIII. Backfill Adjacent to Structures. After the forms are removed from concrete structures, the excavation shall be cleared of all trash and debris prior to backfilling. The fill shall be placed in horizontal layers not to exceed four (4) inches in thickness and compacted by hand tampers or other compaction equipment. At no

APPROVED [illegible] HEAD OF E & W.P. UNIT DATE 1-60

REFERENCE	U. S. DEPARTMENT OF AGRICULTURE	DRAWING NO.
Gordon Clark Lycoming Pa.	SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	ESNE-76 SHEET 2 OF 3 DATE JAN. 60

CONSTRUCTION SPECIFICATIONS

Number 2
EARTH FILL

time during the backfilling operation shall driven equipment be allowed to operate closer than four (4) feet, measured horizontally, to any portion of a structure. Under no circumstances shall the contractor drive equipment over any part of a concrete structure or pipe unless there is a compacted fill of twenty-four (24) inches or greater over the structure or pipe.

APPROVED [illegible] HEAD OF E. & W. P. UNIT DATE 1-60

Sheet 9 of 11

REFERENCE	U. S. DEPARTMENT OF AGRICULTURE	DRAWING NO
GORDON CLARK E. TOPSHAM, VT.	SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER [illegible] PENNSYLVANIA	ESNE-76 SHEET 3 OF 3 DATE [illegible] 60

CONSTRUCTION SPECIFICATIONS

Number 4
PIPE CONDUITS
CORRUGATED METAL PIPE

I. Description. This item shall consist of furnishing and installing sections of corrugated metal pipe to provide a barrel and riser for a drop inlet, spillways, drain pipe, water pipe, or other pipe conduit placed under an earth fill. The pipe shall be the size and type specified.

II. Materials.

a. Corrugated Metal Pipe and fixtures shall conform to the requirements of A. A. S. H. O. Specification M-36. The inside and outside of the pipe and fixtures shall be completely coated with asphalt cement to a minimum thickness of 0.04 inch measured at the crest of the corrugations. The asphalt cement used for the coating shall not be less than 99.5 percent soluble in carbon disulphide and shall adhere tenaciously to the metal, shall not chip off in handling, and shall protect the metal from deterioration.

b. All pipe 18 inches in diameter and larger shall have double riveted seams.

III. Construction Methods.

a. Trench. The width of the trench in which the pipe is placed shall be sufficient to permit thorough tamping of the backfill under the haunches and around the pipe. A minimum width of 2'-0" + the outside diameter of the pipe is to be maintained.

b. Bedding. The pipe shall be bedded in an earth foundation of uniform density, shaped to fit the lower part of the pipe exterior for at least 10 percent of its height. Where rock is encountered, it shall be removed and replaced with suitable compacted earth to provide an earth cushion under the pipe of 8 inches. Where soft, spongy, or other unstable soil is encountered, all such unstable soil shall be removed and replaced with suitable earth compacted to provide adequate support.

IV. Laying Pipe. The pipe shall be placed with the inside circumferential laps pointing downstream and with the longitudinal laps at the sides. The joining of sections of pipe shall be done in a manner so as to secure a watertight joint. When using standard connecting bands, the 2 sections of pipe shall be placed in position and wrapped with 2 layers of heavy asphalt saturated

Sheet 10 of 32

APPROVED [illegible] HEAD OF E. & W.P. UNIT DATE 1-60

REFERENCE	U. S DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	DRAWING NO ESNE-78 SHEET 1 OF 2 DATE JAN 60
GORDON CLARK PUTNEY, VT.		

Number 4
PIPE CONDUITS
CORRUGATED METAL PIPE

roofing felt. The connecting band shall then be placed over the wrapping and securely clamped, with the bolts being placed at the top. When watertight bands are used for joining the sections of pipe, the laps shall be made at the top of the pipe and the rods so placed that the tightening lugs are also at the top. The whole line of pipe shall be true to line and grade, and any deviation shall be corrected before backfilling.

V. Backfilling. Material used for backfilling adjacent to the pipe shall be impervious soil free of large stones, frozen lumps, or debris. It shall be deposited alternately on opposite sides of the pipe in 4-inch layers and thoroughly tamped. Care shall be taken to provide good compaction under the haunches of the pipe. Equipment shall not be driven over any part of the pipe unless there is a compacted fill of 24 inches or greater over the top of the pipe.

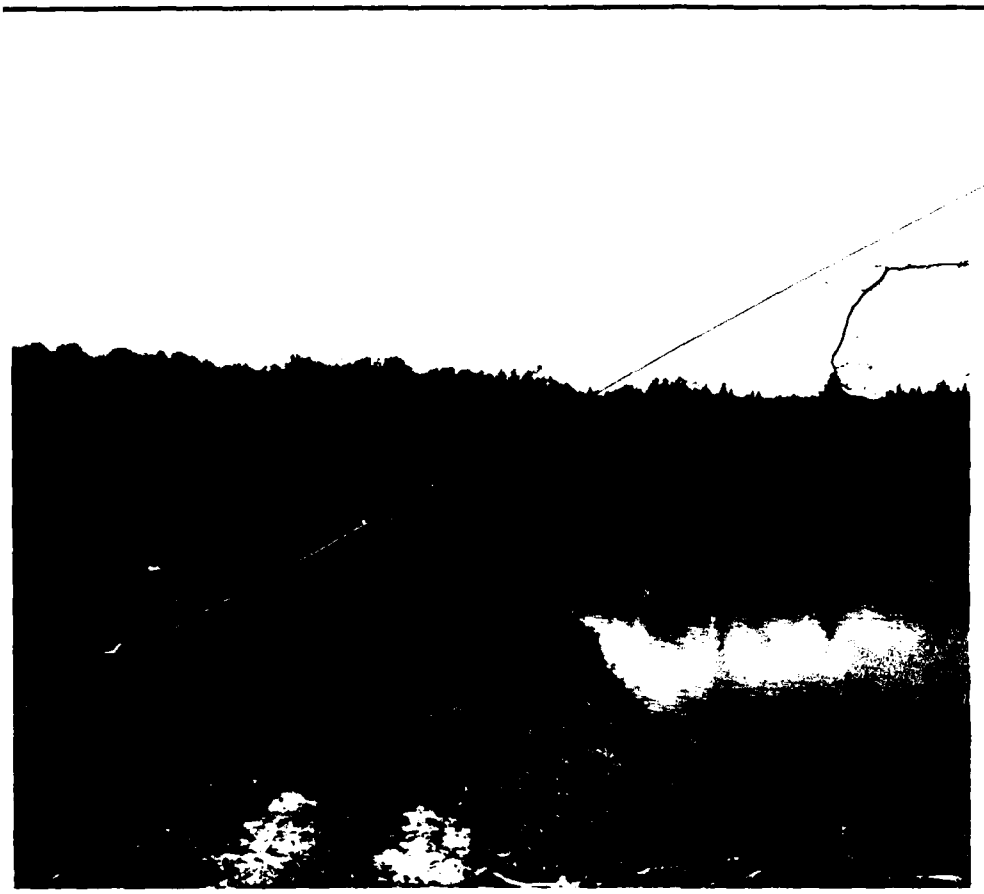
VI. Anti-Seep Collars. Anti-seep collars shall be constructed of the materials specified to the dimensions and at the locations shown on the drawings.

VII. Junctions. Junctions of the conduit with the riser for drop inlets shall be made as shown on the drawings. Valves and other fixtures shall be placed as shown on the drawings.

REFERENCE	U S DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	DRAWING NO. ESNE-78 SHEET 2 OF 2 DATE JAN, 60

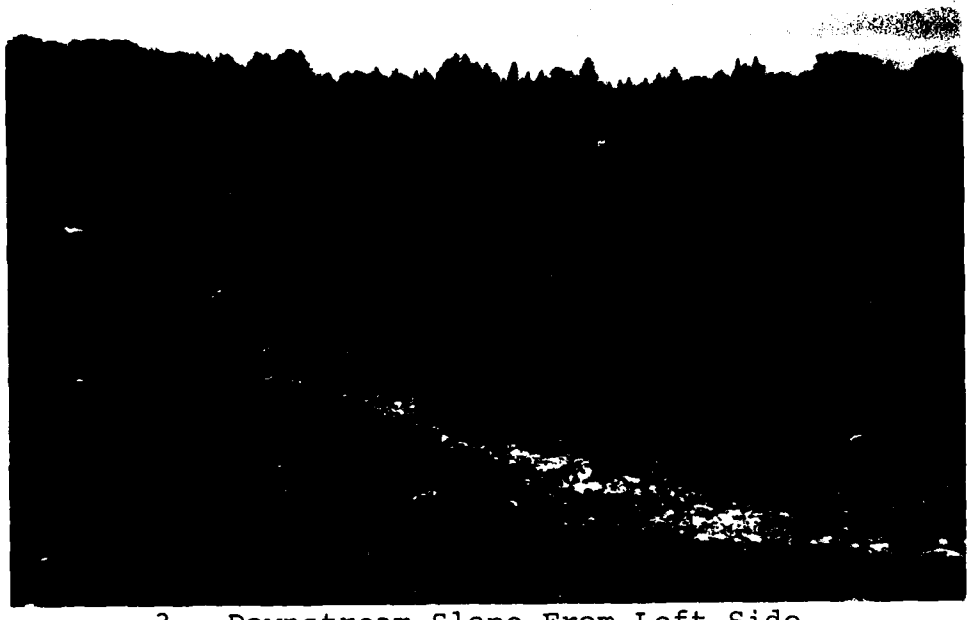
7. Detail of Slough at Left Downstream Abutment

8. Detail of Slough on Downstream Slope

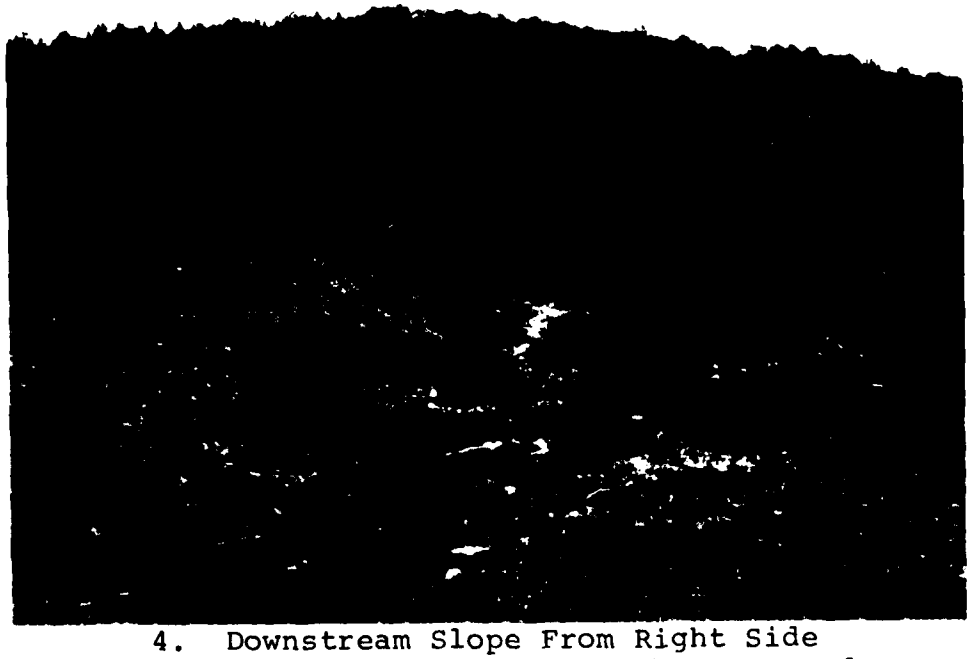


5. Crest of Dam From Left Abutment

6. Drop Inlet of Principal Spillway



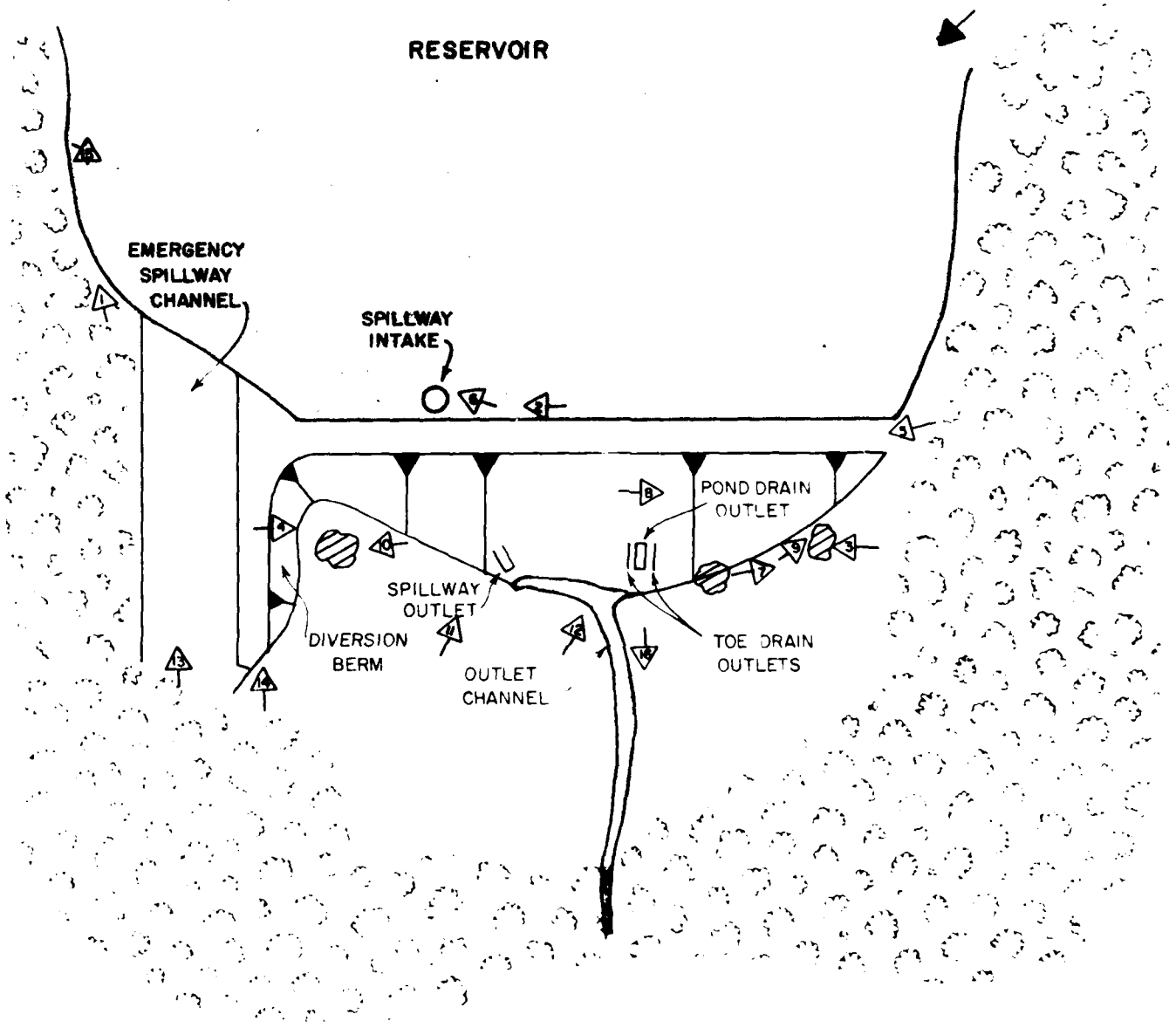
3. Downstream Slope From Left Side.
Note: Diversion Berm at Far End



4. Downstream Slope From Right Side
Note: Slough at Left Abutment and
Erosion of Toe

1. Upstream Slope From Right Side

2. Detail of Brush Growth on Upstream Slope



OVERVIEW PHOTO

APPENDIX C PHOTO

SEEPAGE AREAS

GOLDBERG ZOINO & ASSOCIATES, INC GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS NEWTON UPPER FALLS, MASSACHUSETTS	US ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PHOTO LOCATION PLAN

FILE No. 2605

CLARK SITE No. 2 DAM — TOPSHAM, VERMONT

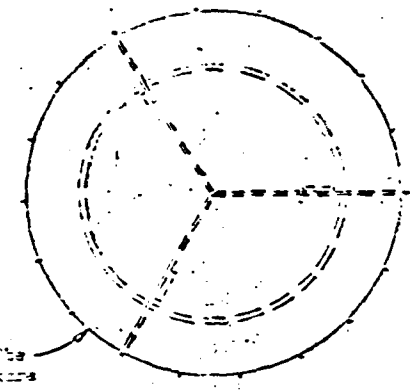
SCALE NOT TO SCALE

DATE JULY 1981

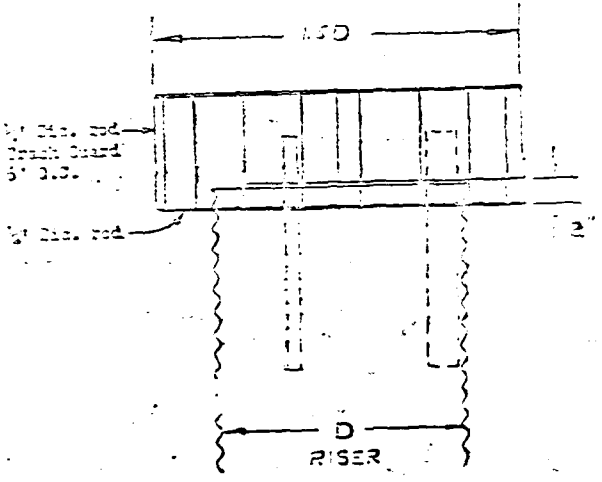
APPENDIX C

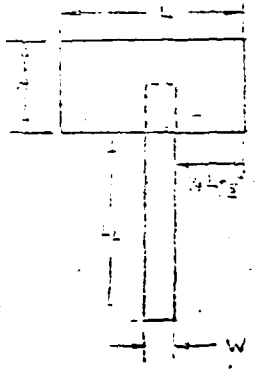
PHOTOGRAPHS

ANTI-VORTEX COVER and TRASH GUARD



				Support Length inches	Leg Width inches	Leg Length inches	Pipe Dia. and Length inches	Pipe Dia. and Length inches	Corner Welds
			5	9	2	16	5	21	
			5	9	2	16	5	30	
		22.5	5	11.25	3	16	7	63	
		22.5	7	11.25	3	16	7	81	
			6	13.5	3	22	8	96	
			9	13.5	3	22	8	132	1/8"
		25	7.5	18	3	22	12	143	
		25	10	18	3	22	12	180	
		45	3.5	22.5	3	22	12	220	
		45	11	22.5	4	23	12	273	
		45	13.5	22.5	4	23	12	325	
		54	12	27	4	23	12	378	
		54	17.5	27	4	23	12	526	
		63	16	31.5	4	23	12	510	





[illegible] length at all joints.

[illegible] with paint or bituminous.

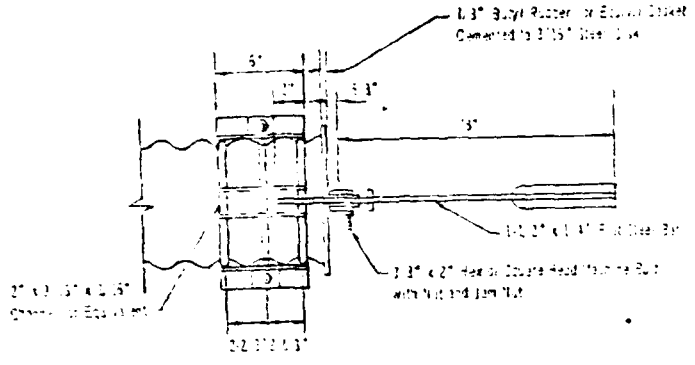
E. TOPSHAM, VT

[illegible] DISTRICT

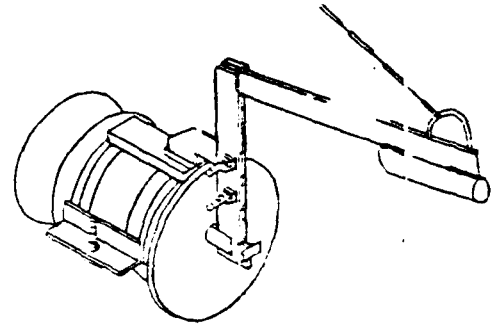
Drawing No.

Sheet 11 of [illegible] Sheets

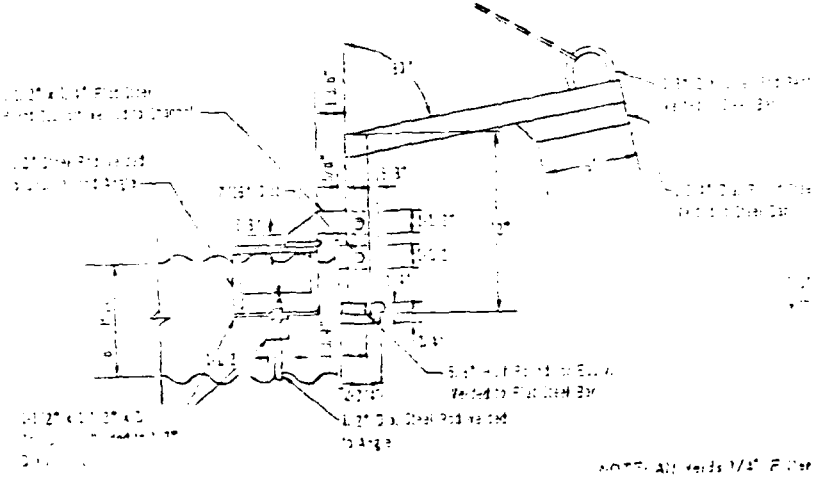
POND DRAIN VALVE FOR 8' CORRUGATED METAL PIPE



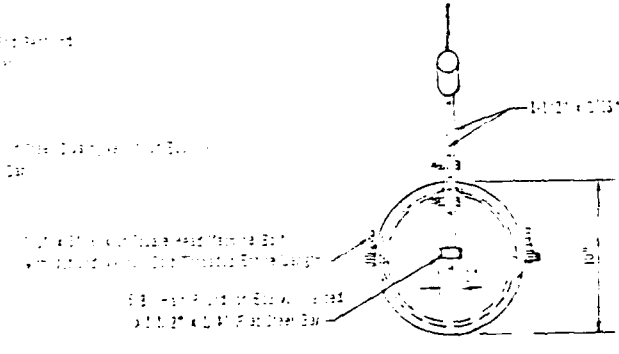
TOP VIEW



ISOMETRIC



SIDE VIEW



END VIEW

SCALE: 1" = 8'

IN COOPERATION WITH
RAYMOND ARNOLD, MORRISVILLE, VT.

DEPARTMENT OF AGRICULTURE
CONSERVATION SERVICE
ASSISTING

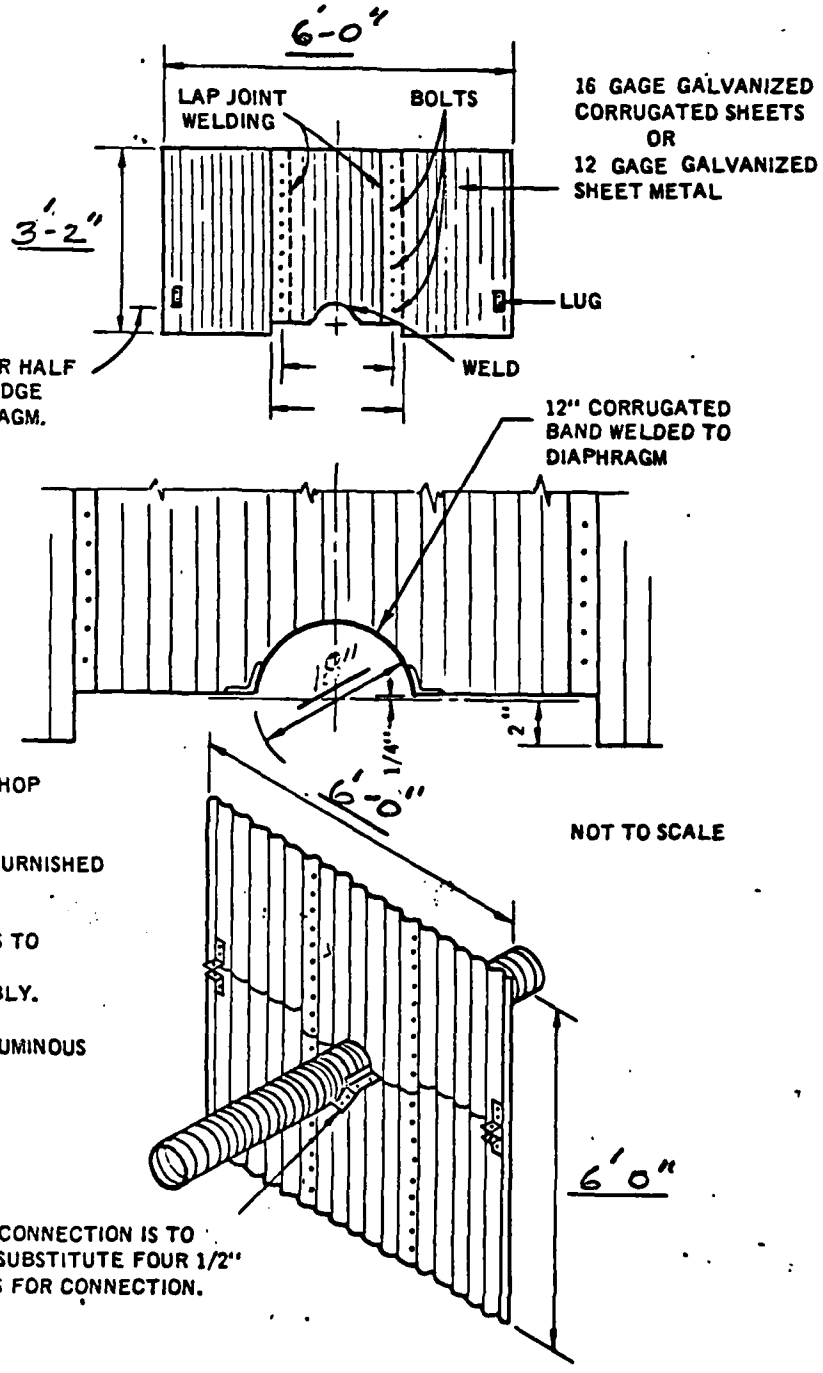
RESOURCES CONSERVATION DISTRICT

ER VT-ENG-7

SHEET OF 23 SHEETS
DATE

PIPE SPILLWAY

2 - PIECE ANTI - SEEP COLLAR



NOTES:

HOLES MATCH PUNCHED IN SHOP TO PERMIT FIELD BOLTING.

GALVANIZED BOLTS TO BE FURNISHED WITH DIAPHRAGM.

LAP BETWEEN TWO SECTIONS TO RECEIVE EXTRA BITUMINOUS COATING AT TIME OF ASSEMBLY.

DIAPHAGM TO BE FULLY BITUMINOUS COATED.

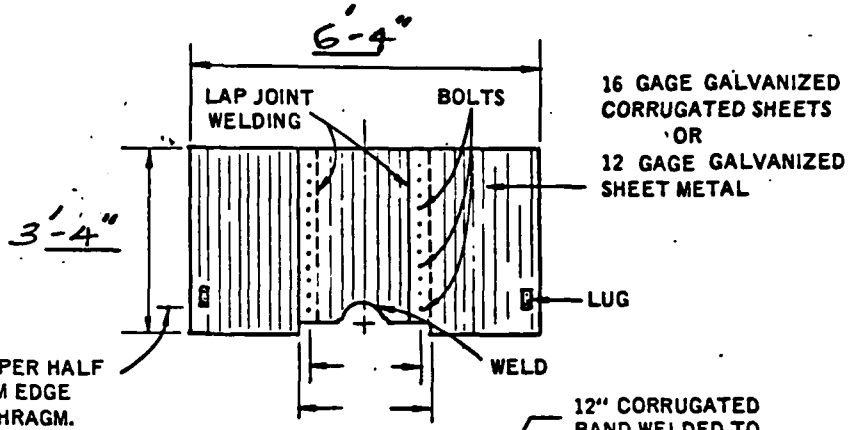
AN ALTERNATE METHOD OF CONNECTION IS TO ELIMINATE ANGLE IRONS, & SUBSTITUTE FOUR 1/2" RODS, WITH TANK TYPE LUGS FOR CONNECTION.

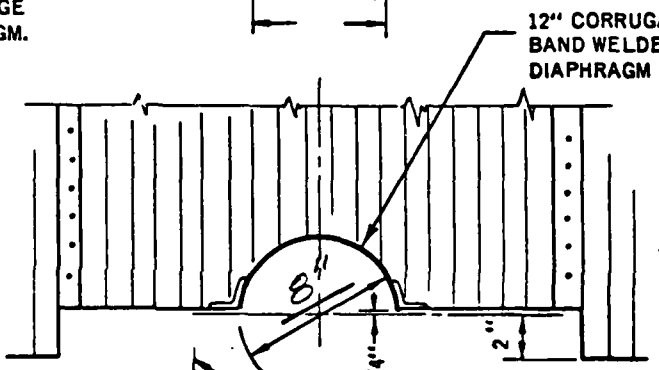
NAME [illegible] CLARK ADDRESS E. TOPSHAM, VT.	U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ASSISTING SOIL & WATER CONSERVATION DISTRICT	DRAWING NUMBER VT - 28 m SHEET 17 OF 22 DATE Rev. 6/66

USDA-SCS-HYATTSVILLE, MD. 19

PIPE SPILLWAY

2 - PIECE ANTI - SEEP COLLAR





NOTES:

HOLES MATCH PUNCHED IN SHOP TO PERMIT FIELD BOLTING.

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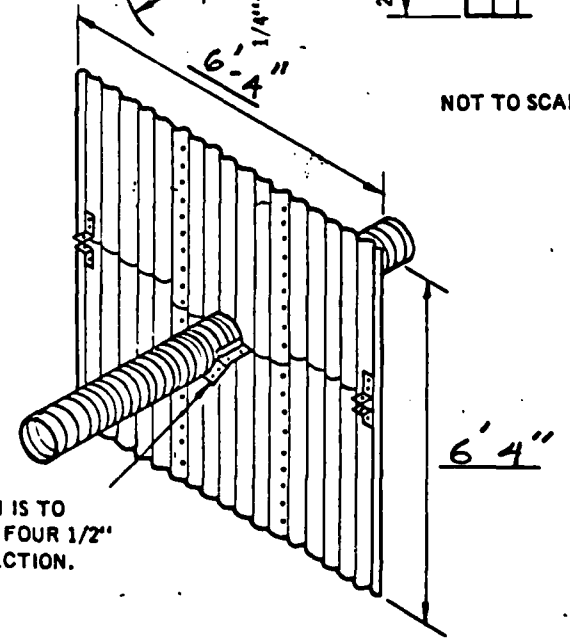


NOT TO SCALE

AN ALTERNATE METHOD OF CONNECTION IS TO ELIMINATE ANGLE IRONS, & SUBSTITUTE FOUR 1/2" RODS, WITH TANK TYPE LUGS FOR CONNECTION.

NAME [illegible] CLARK ADDRESS [illegible], VT	U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ASSISTING SOIL & WATER CONSERVATION DISTRICT	DRAWING NUMBER VT-28m SHEET 16 OF 22 DATE Rev. 6/66

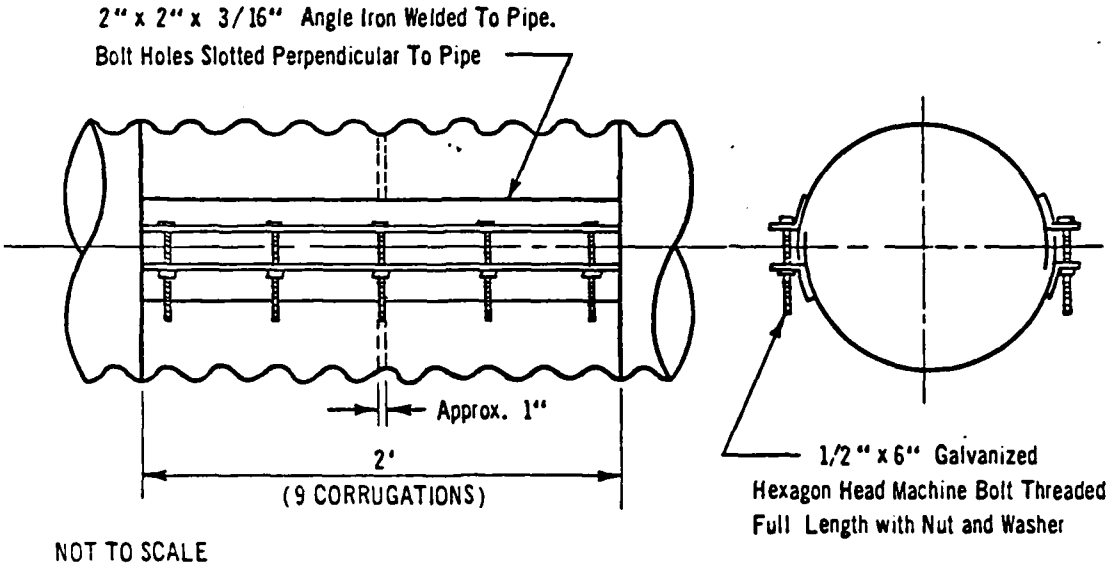
USDA-SCS-HYATTSVILLE, MD. 10

PIPE SPILLWAY CONNECTING BANDS

ASBESTOS BONDED BITUMINOUS COATED CORRUGATED METAL PIPE

2-PIECE CONNECTING BAND

Use for 8"-15" Dia. Pipe



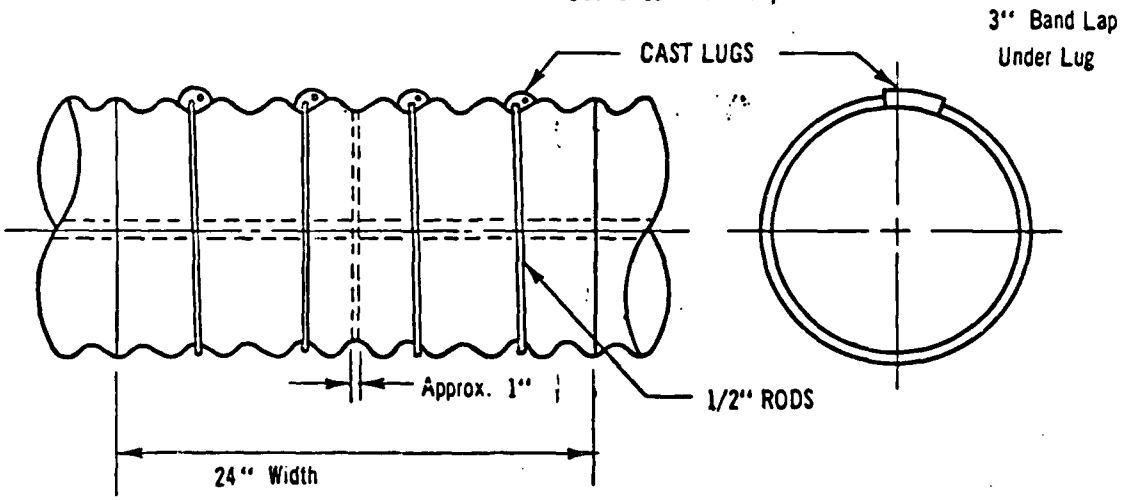
NOT TO SCALE

7 REQUIRED TO FIT 8" DIA. PIPE

— NEOPRENE GASKETS REQUIRED

ROD AND LUG CONNECTING BAND

Use for 18" + Dia. Pipe



NOT TO SCALE

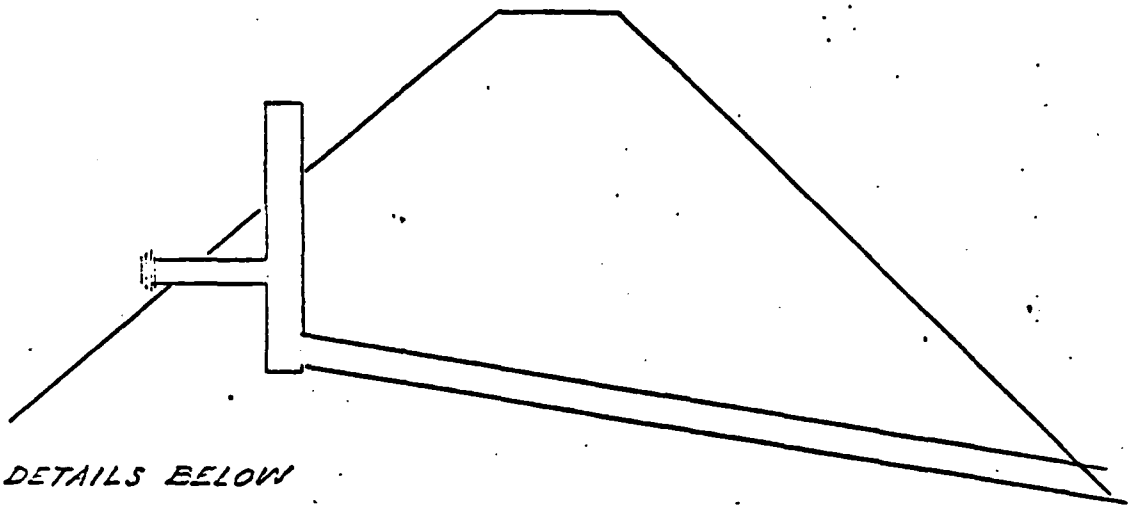
10 REQUIRED TO FIT 18" "DIA. PIPE

REFERENCE GORDON CLARK E. TOPSHAM, VT.	U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ASSISTING SOIL & WATER CONSERVATION DISTRICT	DRAWING NUMBER VT - 28k SHEET 15 OF 22 DATE Rev. 6/66

USDA - SCS

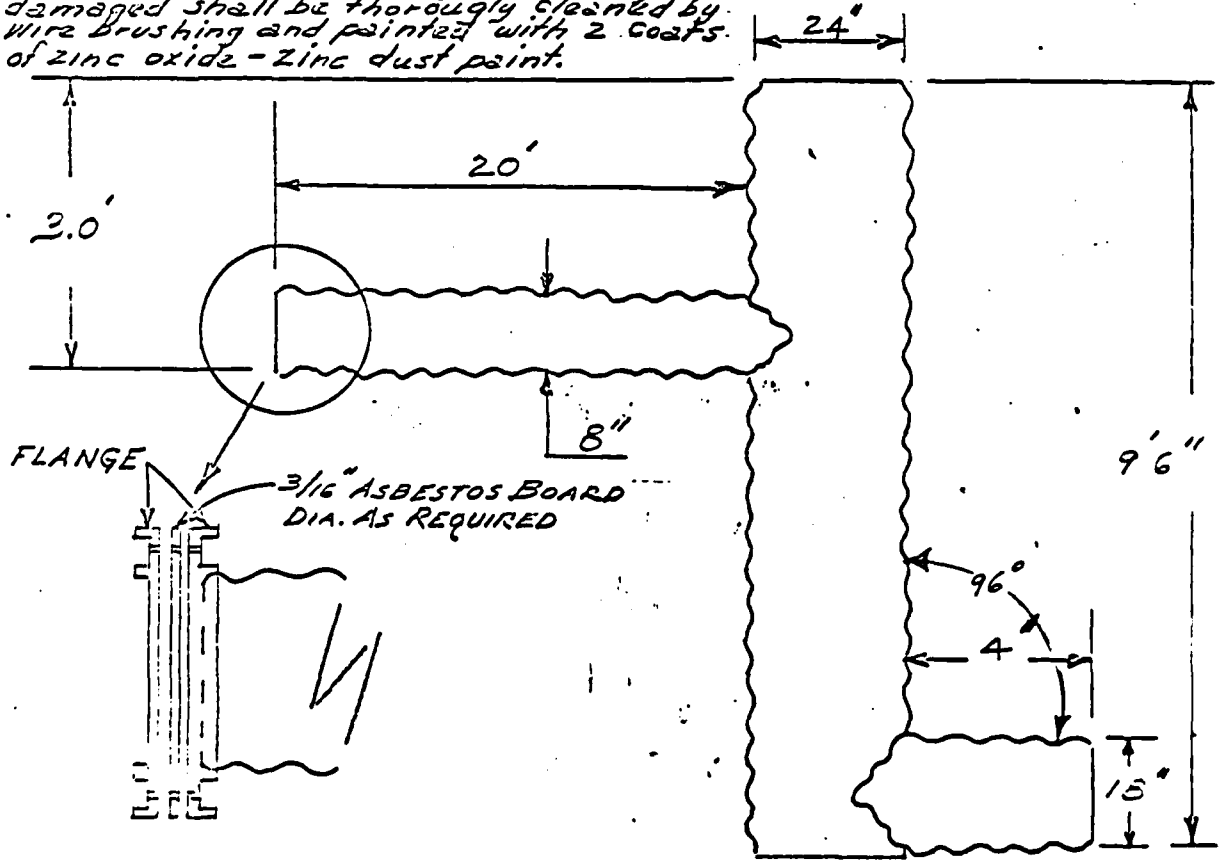
PIPE SPILLWAY

SIDE HILL TYPE WITH DRAIN



DETAILS BELOW

ALL welded areas where galvanizing is damaged shall be thoroughly cleaned by wire brushing and painted with 2 coats of zinc oxide - zinc dust paint.



NOT TO SCALE

REFERENCE	U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ASSISTING	DRAWING NUMBER
GORDON CLARK E. TOPSHAM	SOIL AND WATER CONSERVATION DISTRICT	SHEET 14 OF 22
		DATE

BILL OF MATERIALS

QUANTITY	MATERIAL	REFERENCE
1	PIPE SPILLWAY - SIDE HILL TYPE, WITH DRAIN	
9	20' LENGTHS OF 16" DIA. BCCMP	
1	10' " " 18" " "	
10	ROD & LUG CONNECTING BANDS 18" DIA.	VT-28K
1	ANTI-VORTEX COVER & TRASH GUARD	
5	2-PIECE ANTI-SEEP COLLARS	VT-28n
3	20' LENGTHS OF 8" DIA BCCMP	
7	2-PIECE WATERTIGHT CONNECTING BANDS	VT-28K
1	FARM POND DRAIN VALVE (ARNOLD TYPE)	VT-ENG. 7
4	2-PIECE ANTI-SEEP COLLARS	VT-28n
11	20' LENGTHS OF 6" DIA BCM.C.MP PERFORATED	
1	12' " " 6" " " "	
12	STANDARD CONNECTING BANDS FOR 6" DIA.	
2	END CAPS 6" DIA.	
2	90° ELBOWS 6" "	

DESIGNED GORDON CLARK E. TORSHAM, VT.	U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ASSISTING SOIL AND WATER CONSERVATION DISTRICT	DRAWING NUMBER SHEET 13 OF 22 DATE

CONSTRUCTION SPECIFICATION

DRAIN FILL

1. SCOPE

The work shall consist of placing and compacting drain fill required in the construction of structure drains.

2. QUALITY OF MATERIALS

Drain fill shall be graded as specified and may be pit run material.

3. PLACEMENT

Drain fill shall be placed in layers approximately 6 inches in depth. Extreme care shall be taken to insure the continuity and integrity of all drain fill. The material shall be placed in a manner to avoid segregation of particle sizes. No foreign materials will be allowed to become intermixed with or otherwise contaminate the drains. Any damage to the foundation surface or to the sides or bottoms of trenches occurring during placement of drain material shall be repaired before the Contractor proceeds with the work. The upper surface of drains constructed concurrently with adjacent zones of compacted earth fill shall be maintained at an elevation at least one foot above the upper surface of the adjacent fill. When collector pipes are included in drains the fill materials placed subsequent to the bedding of the pipes shall be placed in a manner to avoid any displacement of the pipes in line or grade.

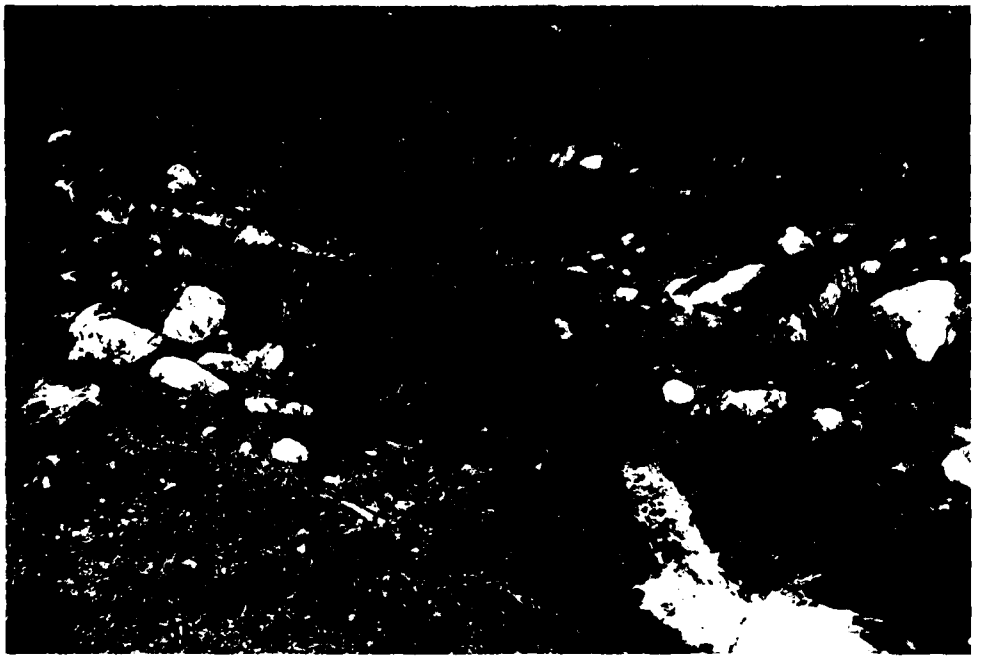
4. COMPACTION OF DRAIN FILL

No special compaction of the drain fill will be required.

JOHN CLARK
LYNDONVILLE, VT.

9. Seepage Collection Well at Left Downstream Toe After Pumping

10. Seepage Collection Well at Right Downstream Toe Before Pumping



11. Downstream End of Principal Spillway Outlet Conduit

12. Downstream End of Pond Drain With Toe Drain Outlets on Either Side

13. Emergency Spillway Channel From Downstream End

14. Crest of Diversion Berm

15. Reservoir Area

16. Downstream Channel

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

Clark Site 2 Dam

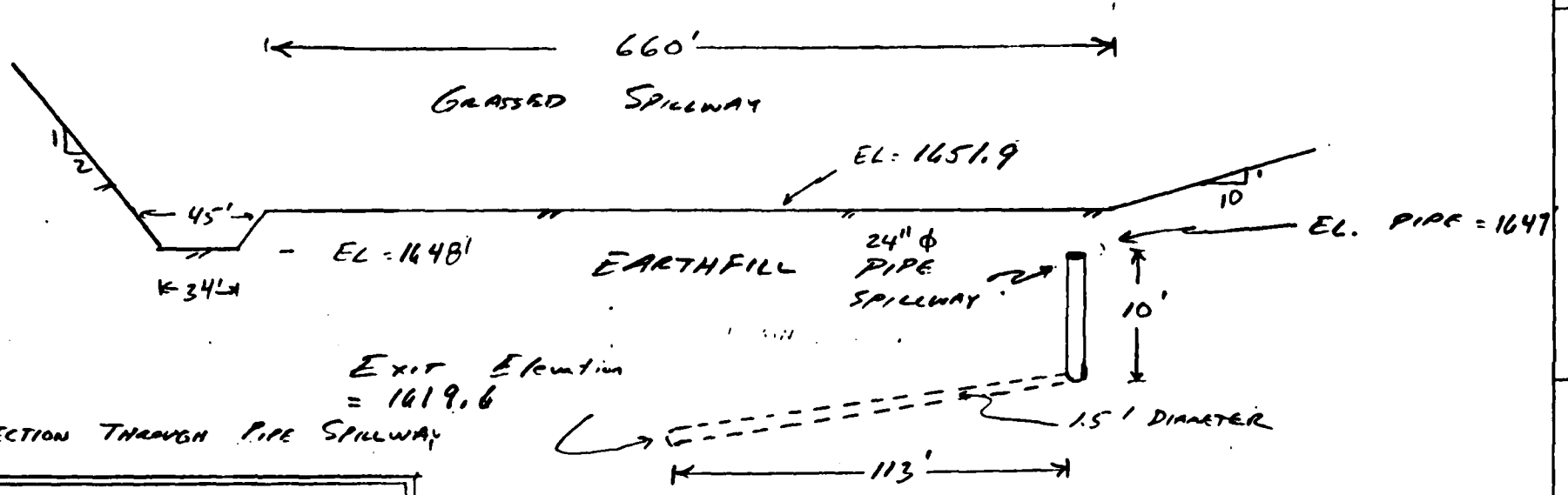
The elevations used in the calculations that follow are based on a toe of dam elevation estimated at 1620' N.G.V.D. from the Woodsville,Vt.-NH 1:62,500 scale U.S.G.S. quad sheet. Relative elevations were obtained from drawings on Sheets 21 and 22 of the SCS design plans.

The principal outlet is a 24" diameter BCCMP riser forming a drop inlet spillway at an elevation of 1647.0' N.G.V.D. An eight inch pond drain provides access to the riser 3 feet below the spillway crest. The bottom of the 10' high riser connects to a 113' long 18" diameter BCCMP which passes through the embankment and exits at the toe with an invert elevation of 1619.6' N.G.V.D. At low flows the 75" length of the riser crest will be the flow control. At higher flows, control will shift to the 18" diameter conduit through the embankment.

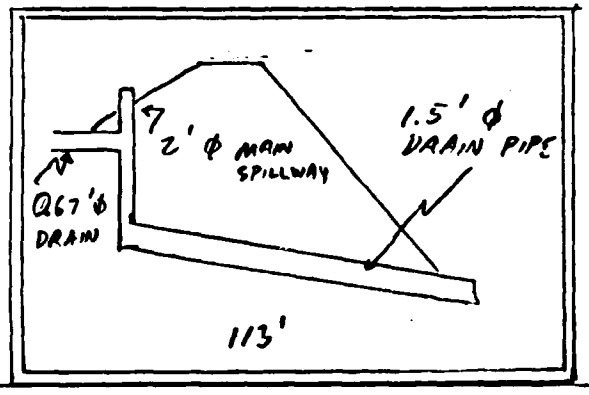
There is also a 6" BCCMP low level pond drain with a standard SCS flap gate at the inlet. The inlet and outlet inverts are 1626.6' N.G.V.D. and 1617.6' N.G.V.D. respectively. Both the 8-inch high level and the 6 inch low level pond drains are assumed closed in analyzing the outlet capacity of the dam.

6/0/81 EEC

CLARK SITE 2 DAM



SECTION THROUGH PIPE SPILLWAY



● POND DRAIN EXIT INV. ELEVATION 1617.6

FROM SCS PLANS

(NOT TO SCALE)

D-3

2/3

The emergency spillway is located at the right dam abutment, not the left as shown on the design plans. It has a bottom width of 34' and 2:1 side slopes on either side. The crest elevation of the emergency spillway is 1648' N.G.V.D.

A design high water of 1649' N.G.V.D. is indicated on the design plans. Discharges of 24 cfs for the principal spillway and 75.4 cfs for the emergency spillway are shown in the pond design calculations. However these discharges are below those that would occur under design high water with normal discharge coefficients. Further calculations for the emergency spillway indicate a design head of 1.0 ft and a design velocity of 4.0 fps, which indicates a design Q of 144 cfs. The weir discharge coefficient under these conditions is approximately 4.0 which is unusually high for a broad-crested weir.

Stage Discharge Computations

Because sufficient back-up data is not provided, weir coefficients of 3.3 and 2.6 for the primary and emergency spillways respectively will be used. A pipe discharge coefficient of 0.65 will be used when the primary spillway is under pressure flow conditions. A weir coefficient of 2.6 will also be used for the 660' long dam crest at elevation 1651.9. Discharges based on the following equations are summarized in the table that follows:

Principal Spillway

$$Q = (3.3)\ (75/12)\ (H_w)^{3/2}$$

or

$$Q = (0.65)\ (\pi)\ \left(\frac{1.5^2}{4}\right)\ (64.4)^{1/2}(H_o)^{1/2}$$

whichever is less

Emergency Spillway

$$Q = (2.6)\ \left\{(34)(H)^{3/2} + (4H)(1/2\ H)^{3/2}\right\} \qquad \text{to elevation 1651.9}$$

$$Q = (2.6)\ \left\{(34)(H)^{3/2} + (8 + 2H)\ (1/2H)^{3/2}\right\} \qquad \text{above elevation 1651.9}$$

Top of Dam

$$Q = (2.6)\ \left\{(660)(H)^{3/2} + (10H)\ (1/2H)^{3/2}\right\}$$

For the Above Equations

H_w = Height above principal spillway = Elev. -1647

H_o = Height above outlet conduit = Elev. -1620.35

H = Height above emergency spillway = Elev. -1648

SUMMARY OF DISCHARGES CLARK SITE 2 DAM

Elevation	Principal Spillway				Emergency Spillway			Top of Dam			Total Q
(ft N.G.V.D.)	Weir Flow		Pressure Flow								
	H_w(ft)	Q(cfs)	H_o(ft)	Q(cfs)	H(ft)[1]	L(ft)[2]	Q(cfs)	H(ft)[1]	L(ft)[2]	Q(cfs)	(cfs)
1647	-	-	-	-	-	-	-	-	-	-	-
1647.5	0.5	7.3	27.15	48	-	-	-	-	-	-	7.3
1648	1.0	21	27.65	48.5	-	-	-	-	-	-	21.0
1649	2.0	58	28.65	49.3	1.0	38	92	-	-	-	141
1651	-	-	30.65	51	3.0	45	530	-	-	-	581
1651.9	-	-	31.55	52	3.9	47	791	-	-	-	843
1653	-	-	32.65	53	5.0	52	1173	0.6[3]	666	800	2026
1654	-	-	33.65	53.5	6.0	54	1530	1.4[3]	674	2860	4443

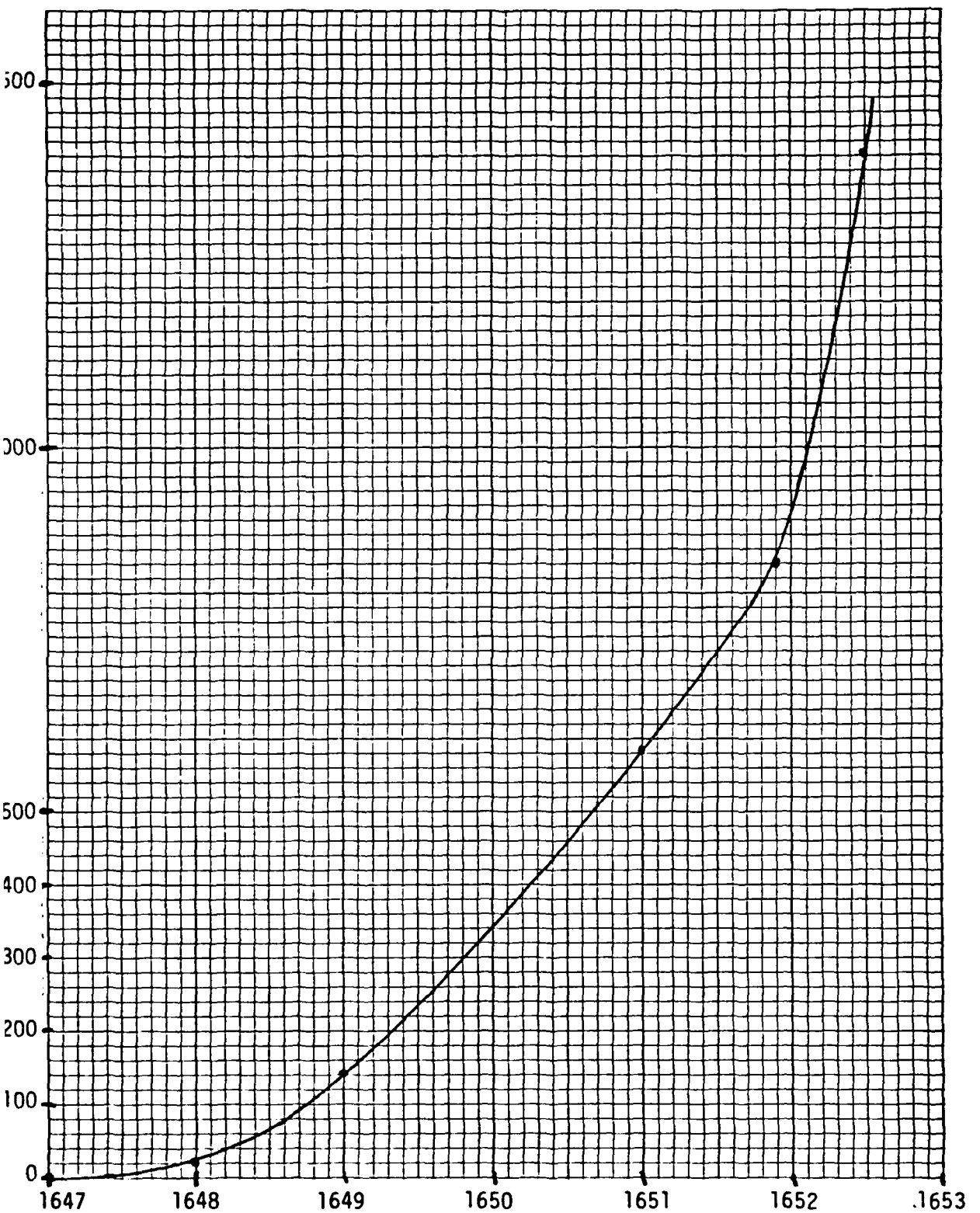
[1] Does not consider adjusted H for side slopes. See equations on previous page

[2] Length of top of water surface

[3] Average H for uneven dam crest

DISCHARGE RATING CURVE

CLARK SITE 2 DAM



Stage Storage Calculations

As a part of design, SCS prepared a plan view of the dam and reservoir area at a scale of 1" = 40' with contour intervals of 2'. The highest continuous contour is assumed elevation 98 (normal pool) which corresponds to actual elevation 1647 N.G.V.D. estimated for this report. Also storage is assumed to be 0 at the upstream low-level outlet invert of 1626 N.G.V.D. By planimetering the area inside of each contour, the storage-elevation relationship can be developed as follows:

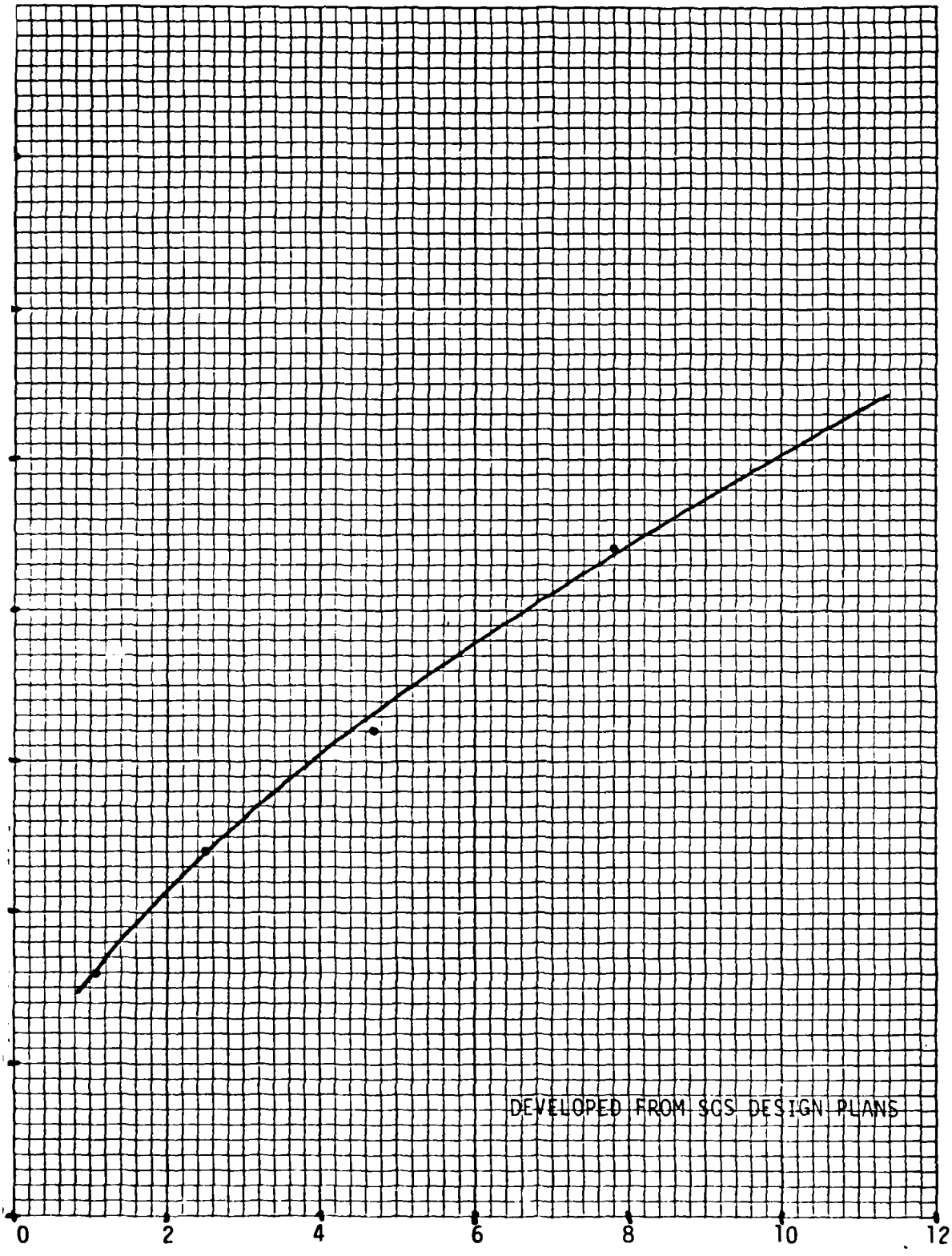
STORAGE-ELEVATION TABLE

Elevation (ft. N.G.V.D.)	Area (ac)	Avg. Area (ac)	ΔH (ft)	ΔS (ac-ft)	Total S (ac-ft)
1626	0				0
1629	0.52	0.26	3	0.78	0.8
1631	0.73	0.63	2	1.25	2.0
1633	1.10	0.92	2	1.83	3.9
1635	1.66	1.38	2	2.76	6.6
1637	2.46	2.06	2	4.12	10.7
1639	3.57	3.02	2	6.03	16.8
1641	4.65	4.11	2	8.22	25.0
1643	5.59	5.12	2	10.2	35.2
1645	6.69	6.14	2	12.3	47.5
1647	7.80	7.25	2	14.5	62.0
1649	9.35*	8.58	2	17.2	79.2
1651	11.1*	16.23	2	20.5	99.7
1652	12.1*	11.60	1	11.6	111.3

*Interpolated from area-elevation curve on next page.

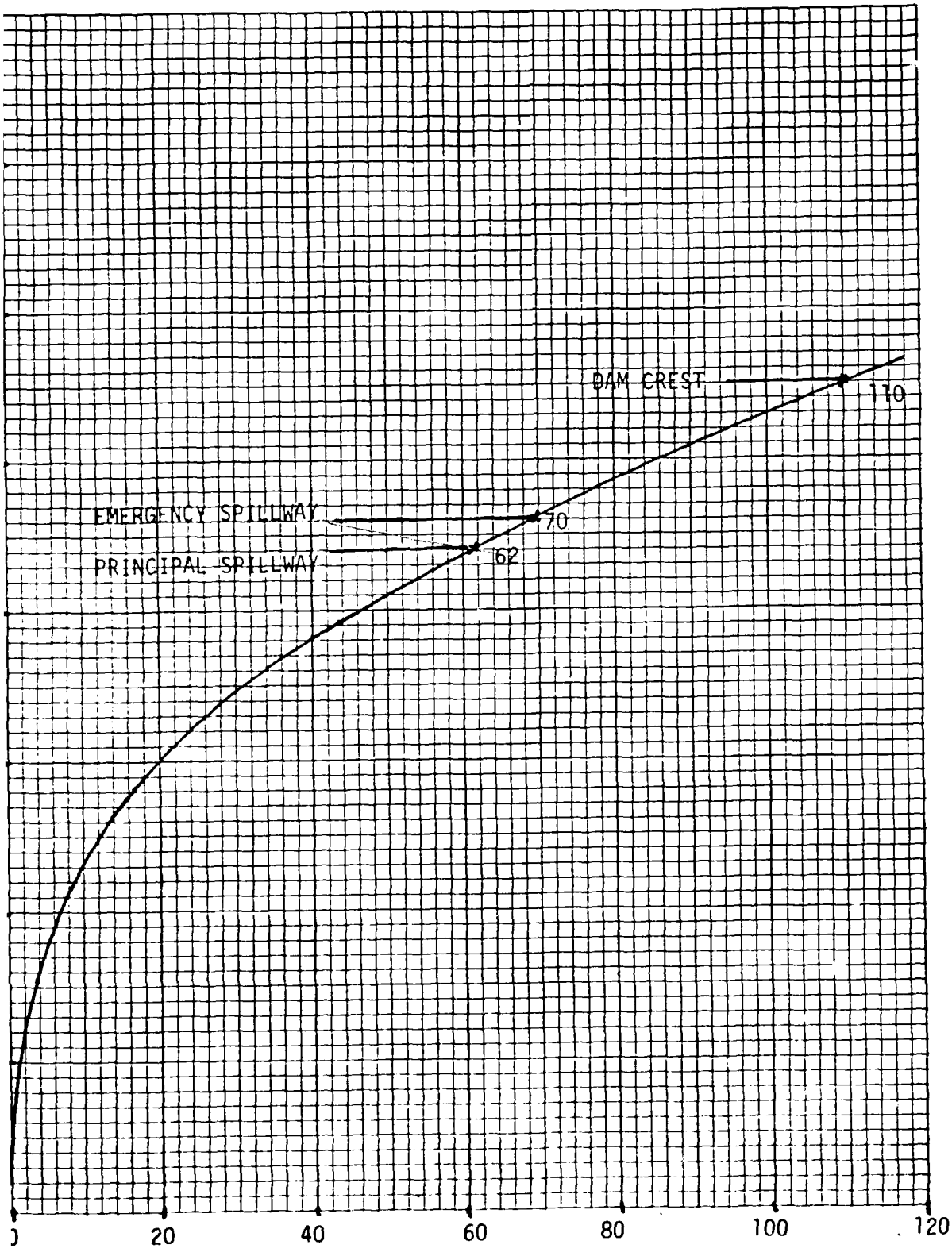
AREA-ELEVATION CURVE

CLARK SITE 2 DAM



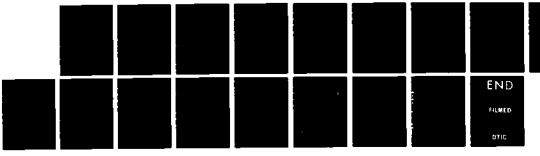
STORAGE-ELEVATION CURVE

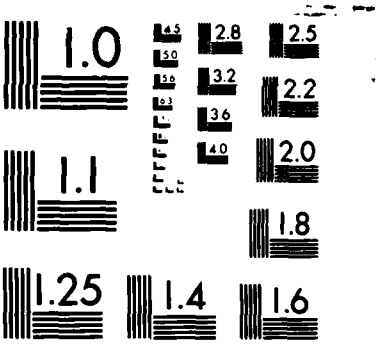
CLARK SITE 2 DAM



AD-A157 516 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 2/2
CLARK SITE NUMBER 2 D.. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV AUG 81

UNCLASSIFIED F/G 13/13 NL





For the drainage area of 145 acres

$$1\text{" of runoff} = \frac{145}{12} = 12.1 \text{ ac-ft./in.}$$

Available storage from the principal to the emergency spillway is 70-62 = 8 ac-ft

$$\frac{8 \text{ ac-ft}}{12.1 \text{ ac-ft/in}} = 0.66 \text{ in. of runoff}$$

Available storage from the emergency spillway to the dam crest is 110-70 = 40 ac-ft

$$\frac{40 \text{ ac-ft}}{12.1 \text{ ac-ft/in}} \simeq 3.3 \text{ in. of runoff}$$

Total available storage from normal pool 70 dam crest is 3.3 + 0.66 = 4.0 in. of runoff.

Dam Failure Analysis

A location and downstream hazard map for the dam is shown at the end of this Appendix. It is assumed that failure occurs with the water surface at the dam crest. Pre-failure outflow and storage are thus 840 cfs and 110 ac-ft respectively for the pre-failure water surface of 1651.9' N.G.V.D.

Peak failure flow = normal outflow + breach outflow

normal outflow = 840

breach outflow = $Q_{p_1} = 8/27 \sqrt{g}\, w_b y_o^{3/2}$

where w_b = breach width = 40% of dam width at 1/2 height of the dam = (0.4)(380) = 152'. The 380' is from an SCS plan view of the dam.

and;

y_o = height above stream bed at time of failure.

$$y_o = 1651.9 - 1622 = 29.9'$$

$$Q_{p_1} = 8/27 \sqrt{32.2}\,(152)(29.9)^{3/2} = 41{,}783 \text{ cfs}$$

Peak failure outflow = 41,783 + 840 $\cong$ 42,600 cfs.

There is no development near the outlet stream immediately downstream of the dam. The first hazard area downstream is approximately 14,000 feet below the dam. The outlet stream is narrow and steep through most of this reach. Three cross-sections, as estimated

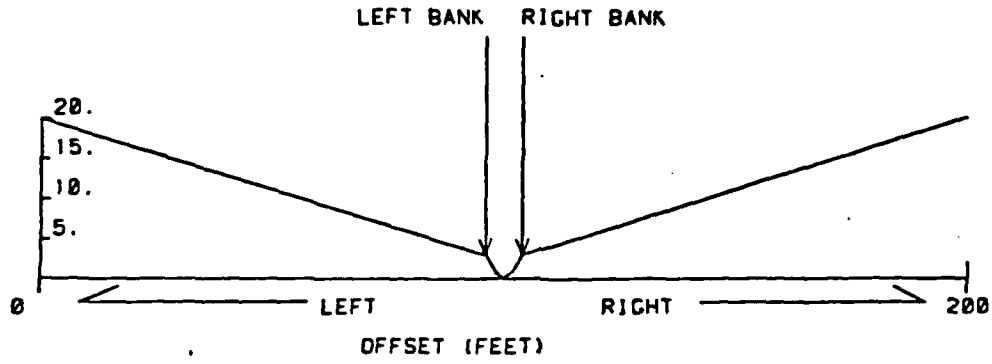
from the U.S.G.S. quad and field notes, are used to route the breach outflow to the impact area at East Topsham. A rating curve of the culvert and road crossing in the damage area indicates the approximate level that the attenuated peak dam failure flow would reach at this highway. The data for the cross-sections, rating curves and peak dam failure attenuation calculations appear on the following pages.

The peak dam failure attenuation calculations indicate that the 42,600 cfs peak failure discharge at the dam would be reduced to 17,400 cfs about 3500' downstream of the dam. The stage at this location would be approximately 14.7 feet above the streambed. At 7000' downstream of the dam the peak flow would be reduced to approximately 10,300 cfs with a stage 12.8 above the streambed. At the impact center in East Topsham the peak flow would be reduced to about 5000 cfs at a stage of about 8.4' above the streambed for unobstructed conditions. However, the obstruction to flow caused by the highway crossing in the impact area would raise the stage to about 13.0' above the streambed or 5.0' above the low point in the highway. The pre-failure outflow of approximately 840 cfs would result in a stage of 10.2' above the streambed or 2.2' over the low point in the roadway in the impact area.

CROSS-SECTION 3500' D/S - NORMAL FLOW CHARACTERISTICS:

DEPTH INCREMENT ,	1.
STREAM REACH SLOPE ,	0.071
LEFT BANK MANNINGS N ,	0.08
RIGHT BANK MANNINGS N ,	0.08
CHANNEL MANNINGS N ,	0.04
LEFT BANK OFFSET ,	96.
RIGHT BANK OFFSET ,	104.

#	OFFSET	DEPTH	ELEVATION
1	0.0	20.0	20.0
2	96.0	3.0	3.0
3	98.0	1.0	1.0
4	100.0	0.0	0.0
5	102.0	1.0	1.0
6	104.0	3.0	3.0
7	200.0	20.0	20.0



===== DATA FOR THE COMBINED SYSTEM =====

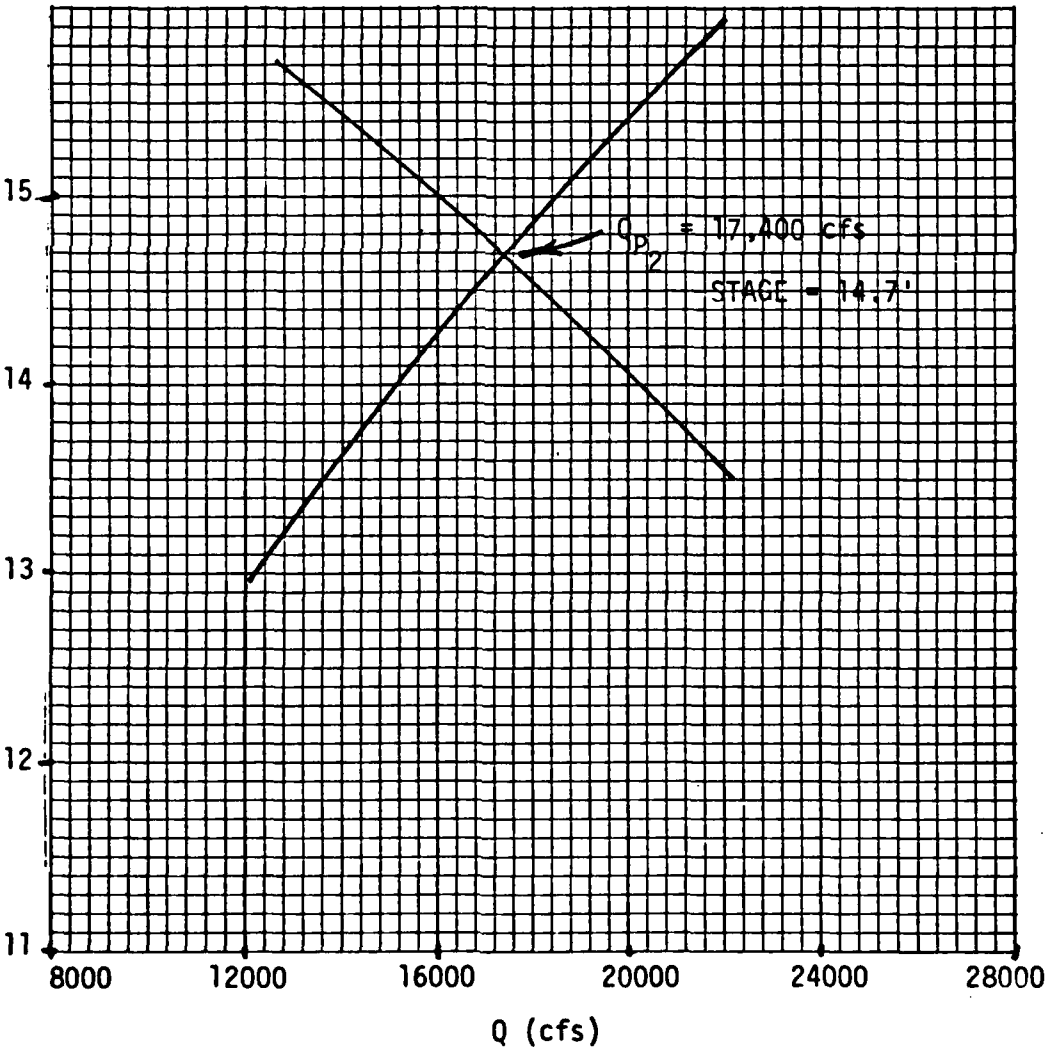
DEPTH ft.	ELEV ft.	AREA ft†2	WPER ft.	HYD-R ft.	AR2/3	Q cfs
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	2.0	4.5	0.4	1.2	11.6
2.00	2.0	7.0	7.3	1.0	6.8	67.6
3.00	3.0	14.0	10.1	1.4	17.4	172.4
4.00	4.0	27.6	21.6	1.3	32.6	383.7
5.00	5.0	52.6	33.1	1.6	71.6	725.1
6.00	6.0	88.8	44.5	2.0	140.7	1237.8
7.00	7.0	136.4	56.0	2.4	246.8	1956.7
8.00	8.0	195.2	67.5	2.9	396.2	2913.2
9.00	9.0	265.3	78.9	3.4	595.2	4136.5
10.00	10.0	346.7	90.4	3.8	849.4	5654.3
11.00	11.0	439.4	101.9	4.3	1164.2	7492.8
12.00	12.0	543.4	113.4	4.8	1545.0	9677.2
13.00	13.0	658.7	124.8	5.3	1996.6	12231.7
14.00	14.0	785.3	136.3	5.8	2523.9	15179.8
15.00	15.0	923.2	147.8	6.2	3131.5	18544.3
16.00	16.0	1072.4	159.2	6.7	3824.2	22347.4
17.00	17.0	1232.8	170.7	7.2	4606.1	26610.5
18.00	18.0	1404.6	182.2	7.7	5481.8	31354.9
19.00	19.0	1587.6	193.6	8.2	6455.4	36601.1
20.00	20.0	1782.0	205.1	8.7	7530.0	42369.4

Attenuated Peak Dam Failure Flow 3500' D/S of Dam

$$Q_{P_2} = Q_{P_1}\left(1 - \frac{STOR}{110}\right) = 42{,}600\left(1 - \frac{STOR}{110}\right)$$

Pre-failure flow of 840 cfs occupies channel to stage = 5.2
(area = 61 sq. ft.)

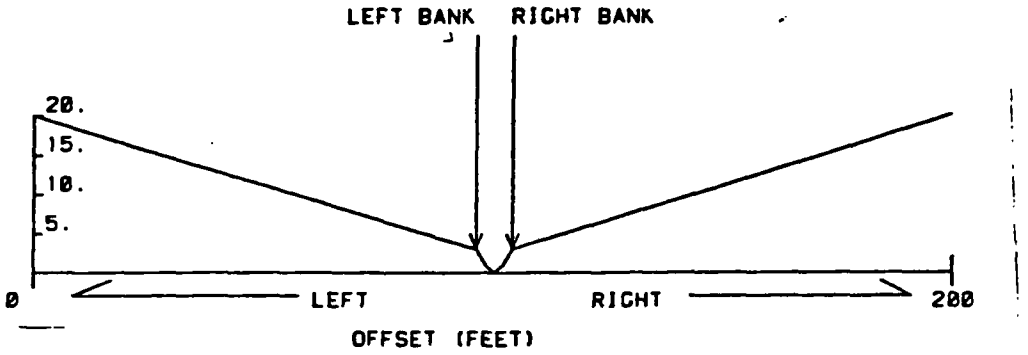
Stage (ft)	Area (above 5.2') (sq.ft.)	Storage $(\frac{\text{Area} \times 3500}{43560})$ (Ac-Ft.)	Q_{P_2} (cfs)
12	482	39	27,500
13	598	48	24,000
14	724	58	20,150
15	862	69	15,900



CROSS-SECTION 7000' D/S - NORMAL FLOW CHARACTERISTICS:

DEPTH INCREMENT :	1.
STREAM REACH SLOPE :	0.056
LEFT BANK MANNINGS N :	0.08
RIGHT BANK MANNINGS N :	0.08
CHANNEL MANNINGS N :	0.04
LEFT BANK OFFSET :	96.
RIGHT BANK OFFSET :	104.

#	OFFSET	DEPTH	ELEVATION
1	0.0	20.0	20.0
2	96.0	3.0	3.0
3	98.0	1.0	1.0
4	100.0	0.0	0.0
5	102.0	1.0	1.0
6	104.0	3.0	3.0
7	200.0	20.0	20.0



===== DATA FOR THE COMBINED SYSTEM =====

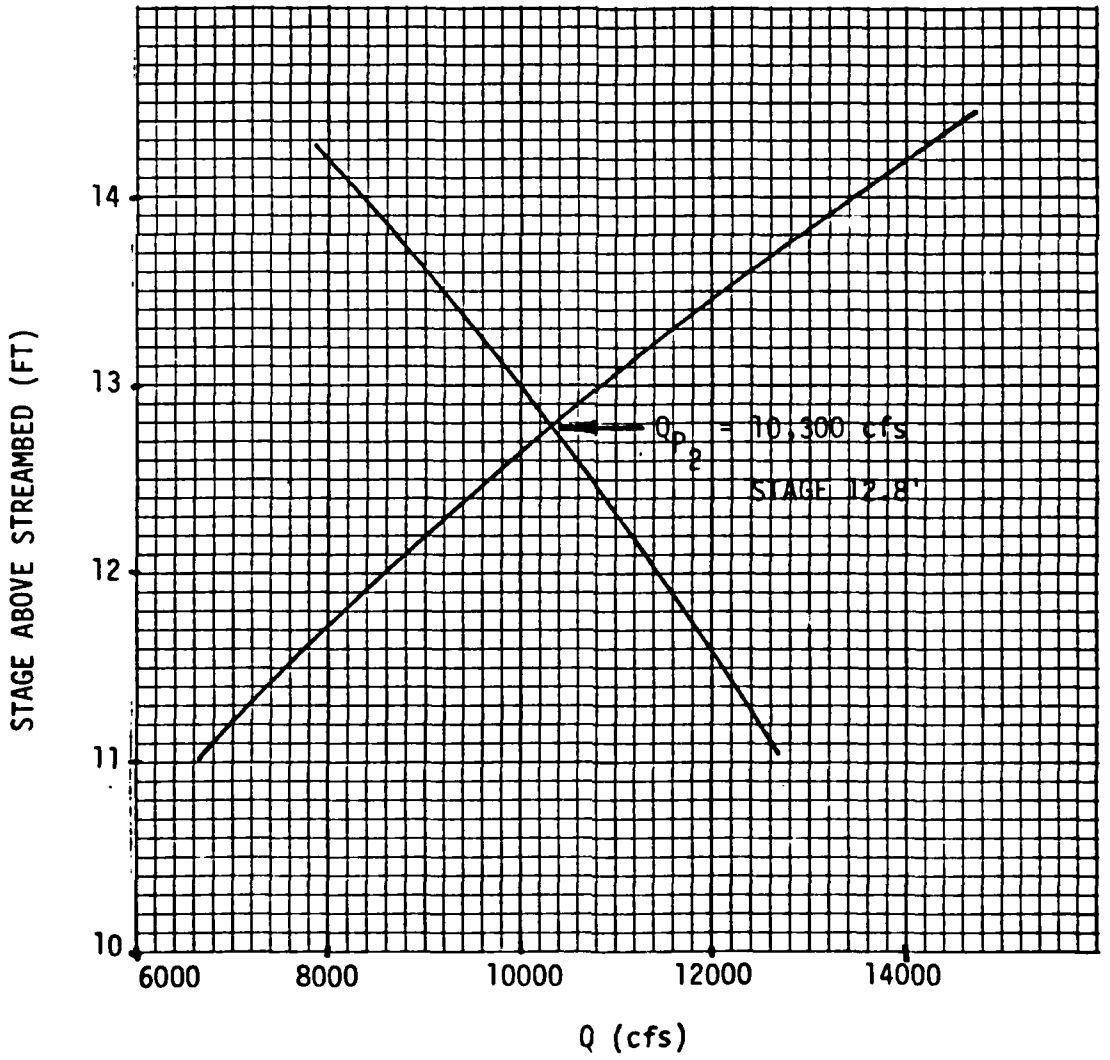
DEPTH ft.	ELEV ft.	AREA ft^2	WPER ft.	HYD-R ft.	AR2/3	Q cfs
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	2.0	4.5	0.4	1.2	10.3
2.00	2.0	7.0	7.3	1.0	6.8	60.0
3.00	3.0	14.0	10.1	1.4	17.4	153.1
4.00	4.0	27.6	21.6	1.3	32.6	340.8
5.00	5.0	52.6	33.1	1.6	71.6	644.0
6.00	6.0	88.8	44.5	2.0	140.7	1099.3
7.00	7.0	136.4	56.0	2.4	246.8	1737.7
8.00	8.0	195.2	67.5	2.9	396.2	2587.2
9.00	9.0	265.3	78.9	3.4	595.2	3673.7
10.00	10.0	346.7	90.4	3.8	849.4	5021.6
11.00	11.0	439.4	101.9	4.3	1164.2	6654.4
12.00	12.0	543.4	113.4	4.8	1545.0	8594.3
13.00	13.0	658.7	124.8	5.3	1996.6	10863.0
14.00	14.0	785.3	136.3	5.8	2523.9	13481.3
15.00	15.0	923.2	147.8	6.2	3131.5	16469.3
16.00	16.0	1072.4	159.2	6.7	3824.2	19846.8
17.00	17.0	1232.8	170.7	7.2	4606.1	23633.0
18.00	18.0	1404.6	182.2	7.7	5481.8	27846.5
19.00	19.0	1587.6	193.6	8.2	6455.4	32505.7
20.00	20.0	1782.0	205.1	8.7	7530.9	37628.5

Attenuated Peak Dam Failure Flow 7000' D/S of Dam

$$Q_{P_2} = Q_{P_1} \left(1 - \frac{STOR}{110}\right) = 17{,}400 \left(1 - \frac{STOR}{110}\right)$$

Pre-failure flow of 840 cfs occupies channel to stage 5.4 (area 68 sq.ft.)

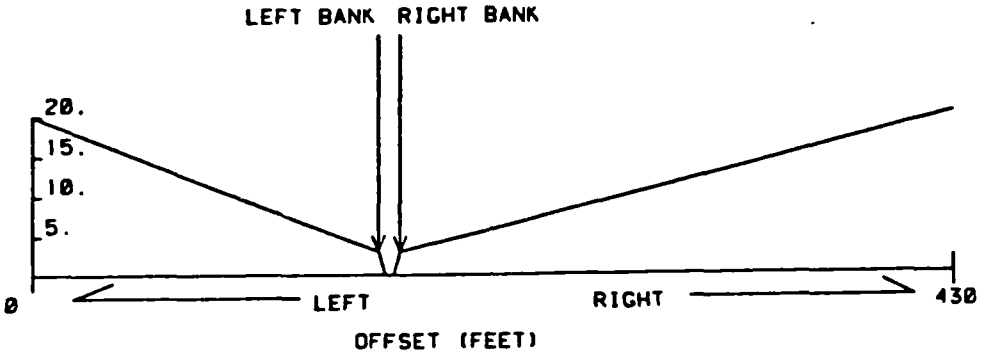
Stage (ft)	Area (above 5.4') (sq.ft.)	Storage ($\frac{\text{Area} \times 3500}{43{,}560}$) (Ac-Ft)	Q_{P_2} (cfs)
11	370	30	12,700
12	475	38	11,400
13	590	47	9,970
14	717	58	8,230



CROSS-SECTION 14000' D/S - NORMAL FLOW CHARACTERISTICS:

DEPTH INCREMENT :	0.5
STREAM REACH SLOPE :	0.039
LEFT BANK MANNINGS N :	0.07
RIGHT BANK MANNINGS N :	0.07
CHANNEL MANNINGS N :	0.035
LEFT BANK OFFSET :	160.
RIGHT BANK OFFSET :	170.

#	OFFSET	DEPTH	ELEVATION
1	0.0	20.0	20.0
2	160.0	3.0	3.0
3	163.0	0.0	0.0
4	167.0	0.0	0.0
5	170.0	3.0	3.0
6	430.0	20.0	20.0



===== DATA FOR THE COMBINED SYSTEM =====

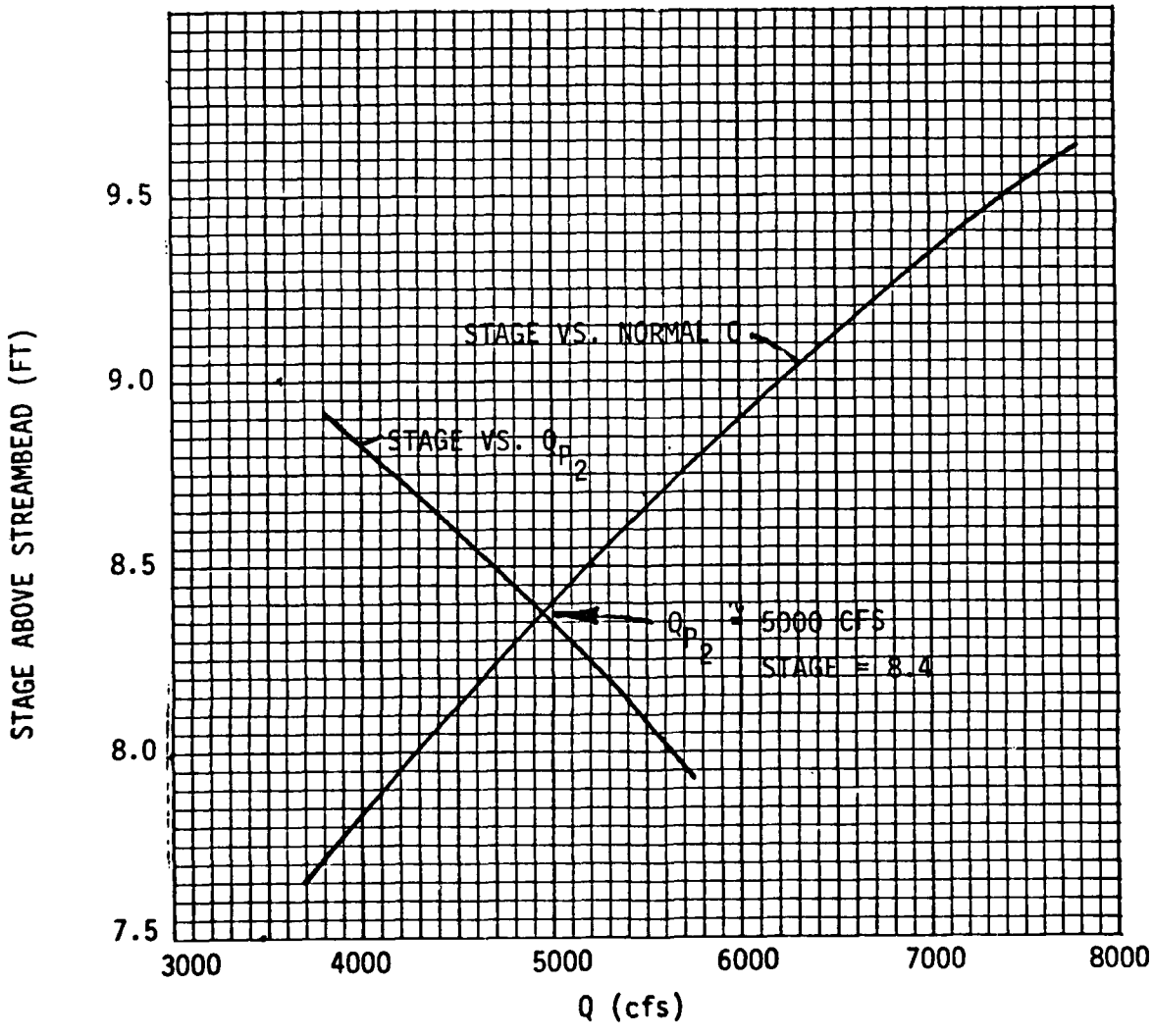
DEPTH ft.	ELEV ft.	AREA ft2	WPER ft.	HYD-R ft.	AR2/3	Q cfs
0.00	0.0	0.0	0.0	0.0	0.0	0.0
0.50	0.5	2.3	5.4	0.4	1.3	10.5
1.00	1.0	5.0	6.8	0.7	4.1	34.1
1.50	1.5	8.3	8.2	1.0	8.3	69.4
2.00	2.0	12.0	9.7	1.2	13.9	116.6
2.50	2.5	16.3	11.1	1.5	21.0	176.4
3.00	3.0	21.0	12.5	1.7	29.7	249.7
3.50	3.5	29.1	24.9	1.2	32.3	361.6
4.00	4.0	43.4	37.3	1.2	47.9	510.5
4.50	4.5	63.8	49.7	1.3	75.4	709.4
5.00	5.0	90.4	62.1	1.5	116.2	968.8
5.50	5.5	123.2	74.5	1.7	172.4	1298.3
6.00	6.0	162.2	86.9	1.9	245.9	1706.7
6.50	6.5	207.3	99.3	2.1	338.8	2202.2
7.00	7.0	258.6	111.7	2.3	452.8	2792.5
7.50	7.5	316.1	124.0	2.5	589.9	3485.3
8.00	8.0	379.8	136.4	2.8	751.6	4287.7
8.50	8.5	449.7	148.8	3.0	939.8	5206.5
9.00	9.0	525.7	161.2	3.3	1155.9	6248.6
9.50	9.5	607.9	173.6	3.5	1401.7	7420.4
10.00	10.0	696.3	186.0	3.7	1678.6	8728.3
10.50	10.5	790.9	198.4	4.0	1988.1	10178.6
11.00	11.0	891.6	210.8	4.2	2331.7	11777.4
11.50	11.5	998.5	223.2	4.5	2710.8	13530.4
12.00	12.0	1111.6	235.6	4.7	3126.9	15443.7
12.50	12.5	1230.9	248.0	5.0	3581.3	17523.0
13.00	13.0	1356.3	260.4	5.2	4075.3	19773.8
13.50	13.5	1487.9	272.8	5.5	4610.4	22201.7
14.00	14.0	1625.7	285.2	5.7	5187.8	24812.1
14.50	14.5	1769.7	297.6	5.9	5808.7	27610.5
15.00	15.0	1919.8	310.0	6.2	6474.6	30602.0

Attenuated Peak Dam Failure Flow 14,000' D/S OF DAM

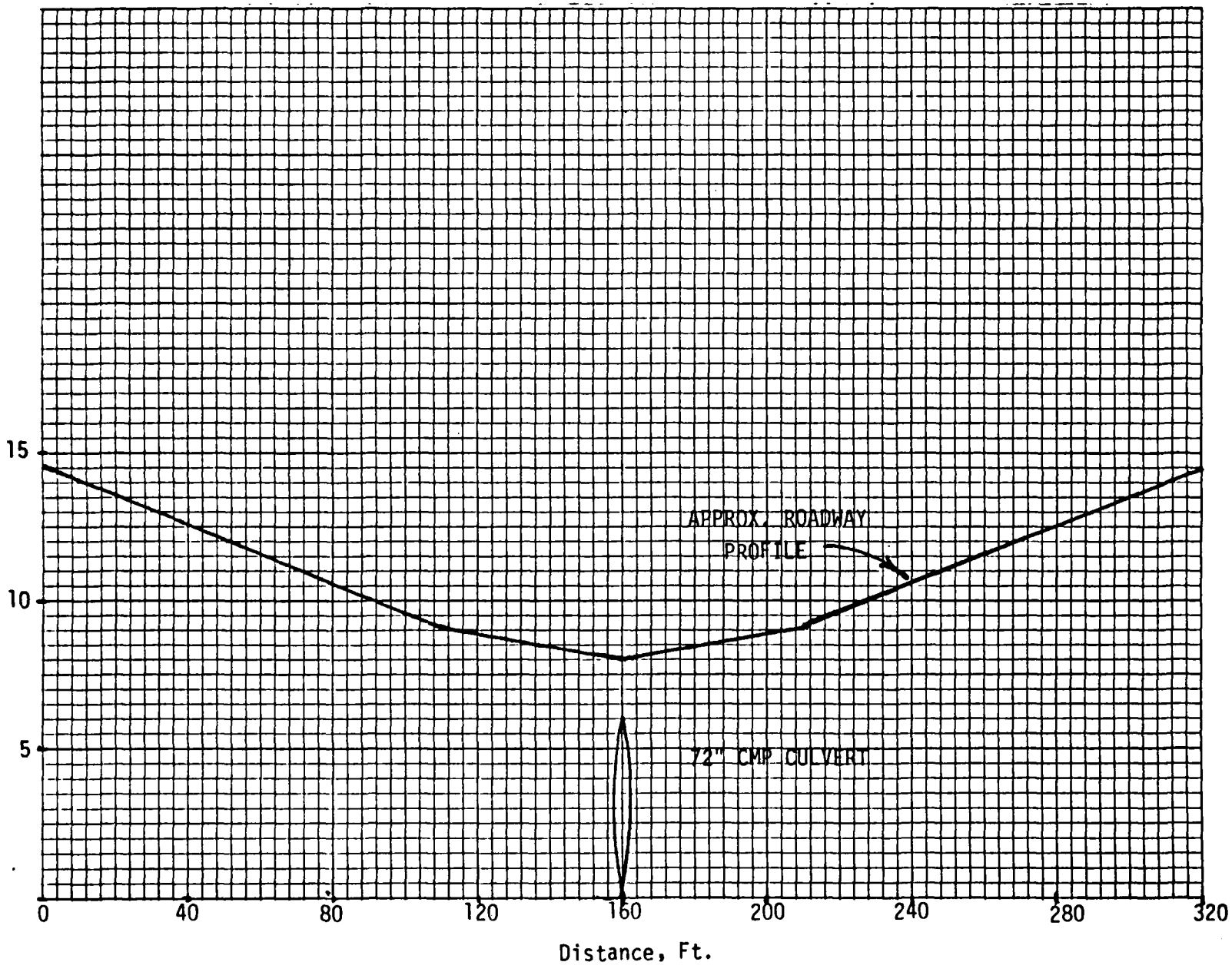
$$Q_{P_2} = Q_{P_1} \left(1 - \frac{STOR}{110}\right) = 10{,}300 \left(1 - \frac{STOR}{110}\right)$$

Pre-failure flow of 840 cfs occupies channel to stage 4.8 (area 78 sq.ft).

Stage (ft)	Area (above sq.ft.)	Storage ($\frac{\text{Area} \times 1000}{43{,}500}$)	Q_{P_2} (cfs)
8.0	302	49	5710
8.5	372	60	4680
9.0	448	72	3560



ROADWAY CROSSING 14000' D/S:



DISCHARGE TABLE FOR ROAD CROSSING

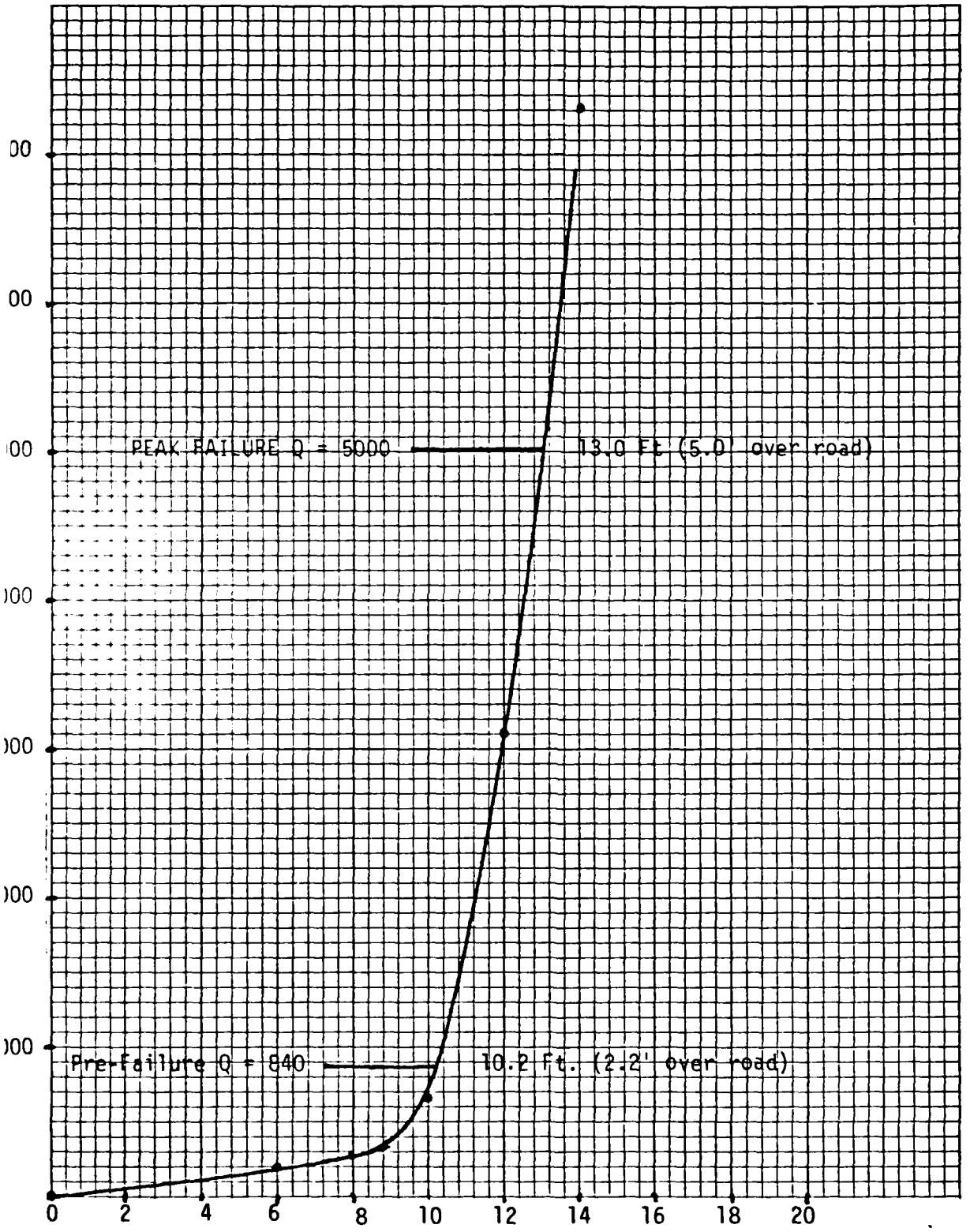
14,000' D/S FROM DAM

Stage Above Culvert Invert (ft)	Q Culvert[a] (cfs)	Q Weir (C=2.8)			Q Total (cfs)
		H[b] (ft)	L (ft)	Q (cfs)	
6	200	-	-	-	200
8	280	0	0	0	280
10	350	1.25	140	550	690
12	410	2.8	220	2890	3110
14	440	3.7	350	6970	7320

[a] From BPR culvert chart for corrugated metal pipe with headwall entrance. Inlet control assumed.

[b] Average H for length of overflow section.

DISCHARGE RATING CURVE - ROAD CROSSING -
14000' D/S OF DAM



Stage, Ft. above Culvert Invert

Development at the impact area in East Topsham consists of 3 houses with first floor elevations ± 3'-5' above the low point in the roadway. The pre-failure flow stage would not create significant flooding problems in the impact area although the unpaved roadway could receive some damage from the ± 2' of overtopping.

The attenuated peak dam failure flow of 5,000 cfs would likely washout the culvert and roadway which would be overtopped by about 4'. Flooding of up to 2' would be experienced at the first floor level of the houses in the impact area. The high velocity of the flood wave, up to 12 fps, presents the possibility for loss of a few lives should Clark Site 2 Dam fail.

Test Flood Analysis

Size Classification: SMALL, storage < 1000 ac-ft, height < 40'

Hazard Classification: SIGNIFICANT

The hazard classification is SIGNIFICANT due to the potential for substantial economic loss and possible loss of a few lives in East Topsham in the event of dam failure.

Test Flood Inflow

Per COE guidelines, the test flood for a SMALL dam with SIGNIFICANT hazard ranges from the 100-year flood to the 1/2 PMF. Because this dam is on the low side of SIGNIFICANT hazard, the 100-year flood will be used.

Method 1 - U.S.G.S. Regression Equation by LeBlanc

$$P_{100} = 0.55\ A^{1.05}\ S^{0.56}\ I^{2.72}$$

where:

P_{100} = peak 100-year discharge in cfs

A = drainage area in sq. mi.

S = main-channel slope in ft. per mi.

I = maximum 2-yr. 24-hr. precipitation in inches.

A = 145 ac = 0.23 sq.mi.

S = $(1830 - 1647)/(\frac{3700}{5280}) = 261$ ft/mi

I = 2.5 in.

Q = $(0.55)(0.23)^{1.05}(261)^{0.56}(2.5)^{2.72}$ = 32 cfs

Method 2 - Rational Formula as described on p. 67 of BUREC'S Design of Small Dams

$$Q = C\ I\ A$$

where:

Q = 100-year discharge in cfs

I = rainfall intensity in in/hr for a duration = T_c

A = area in acres (145 ac)

C = runoff coefficient (assume 0.3)

$$T_c = \left[\frac{11.9L^3}{H}\right]^{0.385}$$

T_c = time of concentration in hours

L = length of longest watercourse in miles

H = elevation difference in feet

$$T_c = \left[\frac{(11.9)(3700/5280)^3}{(1830-1647)}\right]^{0.385} = 0.23 \text{ hr} = 14 \text{ min.}$$

Adjust T_c for SCS CN of 65 (p. 67 Design of Small Dams)

(14)(1.6) = 22 min, say T_c = 20 min.

From Hydrometeorological Report No. 35 the estimated 20-min precip. is 1.6", or 4.8"/hr.

$$Q = (0.3)(4.8)(145) \cong \underline{210 \text{ cfs}}$$

Method 3 - Assume 100-year flood peak = $\frac{1}{4}$ PMF peak

From COE "Maximum Probable Flood Peak Flow Rates" PMF peak = 2600 CSM

$$2600 \text{ CSM} \times \frac{145 \text{ Ac}}{640 \text{ Ac/SM}} \quad 589 \ddagger \quad \frac{590}{4} = 147 \approx \underline{150 \text{ cfs}}$$

The Test Flood inflow will be taken as 150 cfs.

Test Flood storage routing:

PMF = 590 cfs = 19" runoff

Test Flood Inflow = 150 cfs

Test Flood Runoff = $(\frac{150}{590})$ (19) = 4.8" runoff

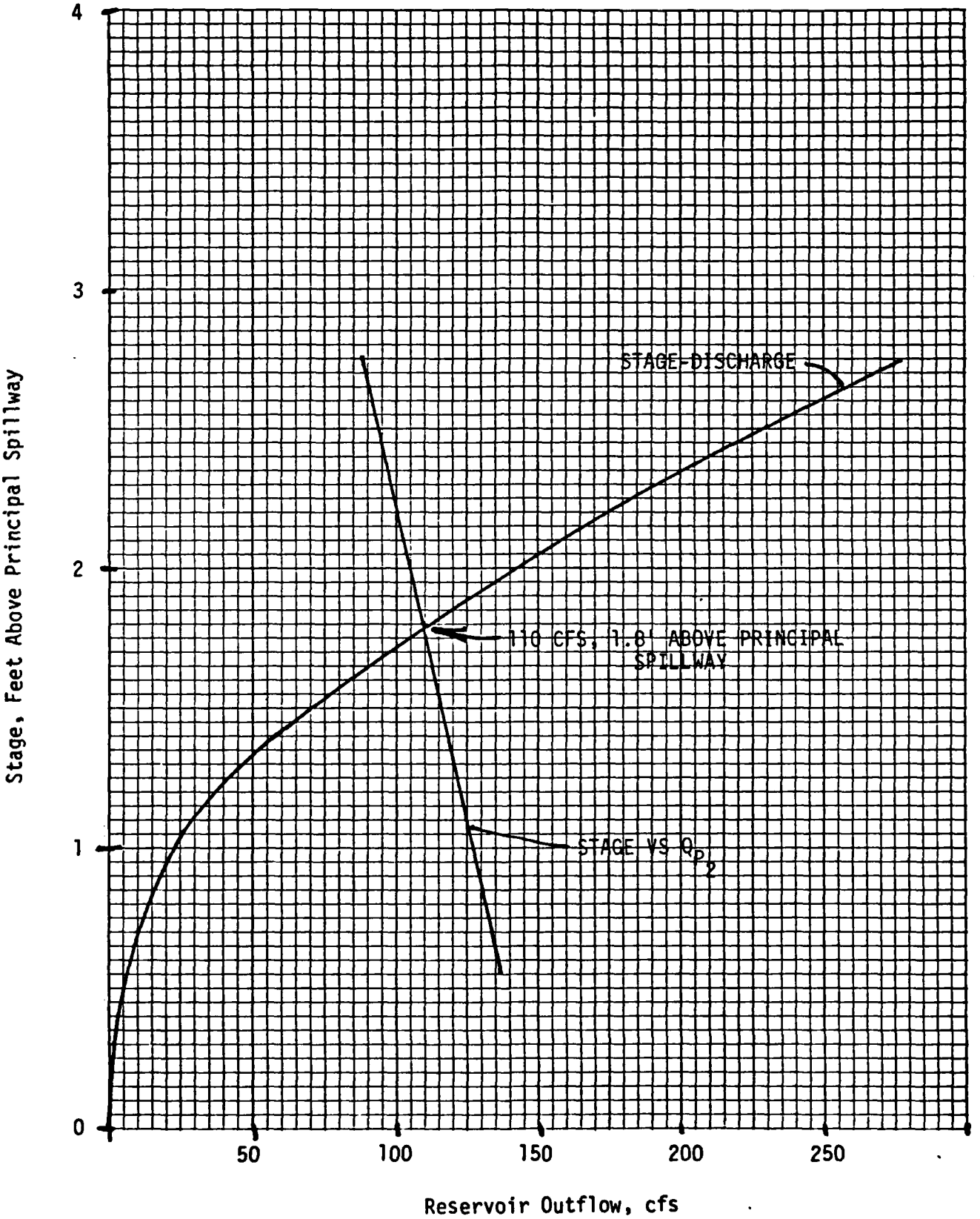
$$Q_{P_2} = Q_{P_1}\left(1 - \frac{\text{STOR}}{\text{T.F. Runoff}}\right)$$

$$\text{STOR} = \text{T.F. Runoff}\ \left(1 - \frac{Q_{P_2}}{Q_{P_1}}\right)$$

$$\text{STOR} = 4.8\left(1 - \frac{Q_{P_2}}{150}\right)$$

ROUTED PEAK TEST FLOOD OUTFLOW

CLARK SITE 2 DAM



Q_{P_2}	STOR (in)	STAGE = (1.4 x STOR)
0	4.8	6.7
30	3.8	5.3
60	2.9	4.1
90	1.9	2.7
120	1.0	1.4
150	0	0

Test Flood Results

The peak test flood inflow of 150 cfs produces a routed peak test flood outflow of 110 cfs. This flow would produce a depth of 0.8' over the emergency spillway, 3.1' below the crest of the dam.

For a water surface at the dam crest of 1651.9:

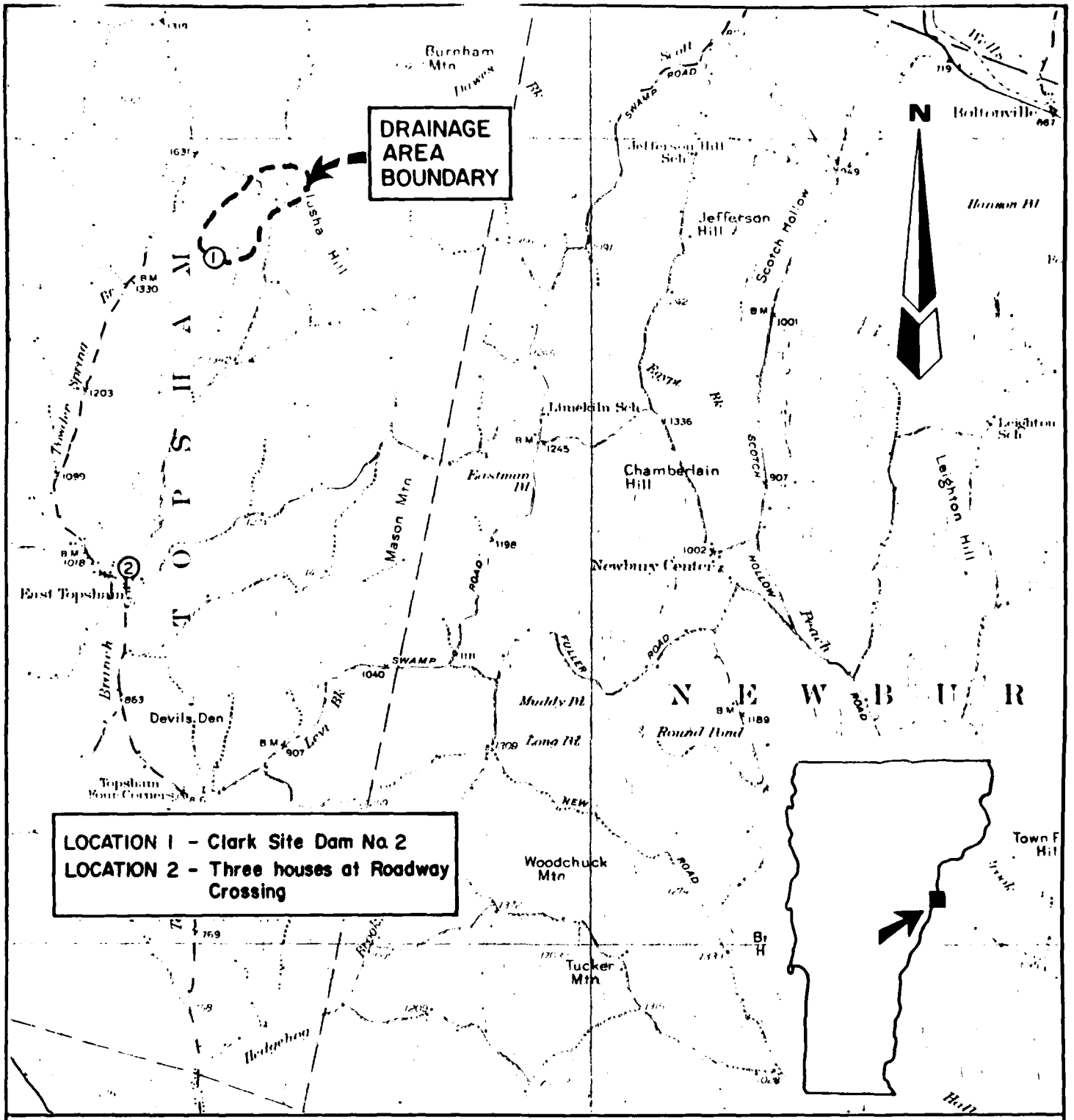
Principal Spillway Flow = 50 cfs

Emergency Spillway Flow = 790 cfs

Total outlet capacity = 840 cfs

$$\text{Outlet capacity} = \frac{840}{110} \times 100$$

= 760% of Test Flood outflow



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NEWTON UPPER FALLS, MASSACHUSETTS

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND DOWNSTREAM HAZARD MAP

FILE No. 2605

CLARK SITE No. 2 DAM TOPSHAM, VERMONT

SCALE AS SHOWN

DATE JUNE 1981

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME

END

FILMED

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